DIXON's

METHODISED SYSTEM

OF

NAVIGATION.

534. b.
2
7ccb .31.

THE
NAVIGATOR'S ASSISTANT;
OR, A
New and Methodiſed Syſtem
OF
NAVAL MATHEMATICS:

CONTAINING
Every thing Neceſſary for determining a Ship's Place at Sea
by Obſervation; with a full and comprehenſive Diſplay
of the Uſeful Parts of

PRACTICAL NAVIGATION.

THE WHOLE EXEMPLIFIED IN
A JOURNAL from the LIZARD to FUNCHAL.

DESIGNED FOR THE
USE OF SCHOOLS, AND YOUNG MARINERS.

K

BY GEORGE DIXON,
TEACHER OF NAVIGATION, AND ASTRONOMY,
GOSPORT, HANTS.

London:
PRINTED for the AUTHOR, by J. MOORE, No. 134, Drury-Lane;
And ſold by Meſſrs. RIVINGTON and SONS, St. Paul's Church-Yard; MOUNTS and PAGES, Tower-hill; EGERTON,
Charing-Croſs; HARDING, Goſport; and by the
BOOKSELLERS at the Principal Ports.

M.DCC.XCI.

This Book is entered at STATIONERS-HALL,

AGREEABLE TO ACT OF PARLIAMENT.

PREFACE.

GREAT BRITAIN for its Learning, Manufactories, and Trade, ſtands unrivalled in the Annals of Fame; and from its flouriſhing State, will ever be an Example to others, for the Advancement of an Art, which is ſo Eſſential to the being of Trade, and the enriching of a commercial Country.

THE Benefits of Navigation extend to every Condition in Life; Merchants experience its kind Influences; Perſons wiſhing to travel can make Excurſions to all Parts of the Globe; Individuals are thereby abundantly provided for; and it is a Nation's Defence againſt foreign Enemies, where a Fight at Sea, proves leſs deſtructive than an Engagement by Land.

THIS uſeful Branch of the Mathematics is divided into two principal Parts, *viz:* The WORKING PART, and the GUIDING OR PILOTING PART: each of which ſhould be well underſtood by every Officer, to whom the Care of a Ship is entruſted; as the Ship, Lives, and Property on Board, are ſecondarily committed to their good Management.

The Art of *Piloting* a Ship has long been in Cultivation, and indeed it demands every Attention to bring it to Perfection. Wright, Norwood, and Halley, did much in this Reſpect; and our modern Navigators have not been backward, in contributing their Obſervations to the common Stock: yet their Labours may be improved, and diſpoſed of in a more methodical Manner.

Mons. Pitot in his Theory of Working Ships, ſays, that this Part "ſeems to want nothing but the Longitude "to bring it to Perfection:" may we now be bold to ſay that it has arrived at that State, ſeeing the Longitude can be ſo nearly determined by the Lunar Observation*, and the Latitude ſo accurately by Double Altitudes†? I think it needs *no* Interrogation; and may without ſingularity be ſettled on this Baſis, that it is advanced ſo far towards a State of Perfection, that except Time-keepers ſhould be brought into uſe at Sea, it cannot receive any greater Improvement.

But the Mariner's Ideas are not to be confined to this Part alone, there is ſtill a nobler Part, if I may ſo call it, *viz:* The Working a Ship; for if a Perſon was ever ſo well ſkilled in the firſt, and had no Knowledge of this, it would be dangerous to put to Sea with him, and not only ſo, the Deſtruction of the Ship would be certain. The Advantages that naturally ariſe from this Part of Navigation, are, how to give the beſt Situations to the Sails and Rudder, ſo as to make the greateſt Way poſſible; moſt readily Tack-about; exactly find the Leeway, and conſequently the true Courſe made good: the beſt Eſtimate of the Ship's Way, and from hence her Place at any Time; which is all that can be required of the Art, to perform a Voyage with as much Certainty, Expedition, and, in a Word, Perfection as poſſible. Add to this, that by the help of a Perſon expert at the working of a Ship, the Seamen will be enabled to make a good Uſe of the Winds; get clear of a Coaſt, weather a Cape, avoid Dangers, follow a Ship, give chace to or avoid her, or get the Advantage of the Wind and keep it, eſpecially in a Sea-fight. But, as it is not my Buſineſs to inſiſt on this at preſent, I will proceed to give my principal Reaſon for writing this Treatiſe, ſeeing there are ſo many already on the ſame Subject; and that is, to preſent the TEACHER and PRACTITIONER with a methodiſed form of Navigation which has long been wanted.

---

* My Method, p. 98, is an Improvement on Dunthorne's Method, p. 32, R. T.

† My Method is an Improvement on Prob. vii. Book ix. of Robertſon's Navigation.

ROBERTSON in his Elements, ſays, "I have always "thought, that the chief Motives which ought to induce "a Perſon to appear as an Author, ſhould be, either the "having ſomething new to publiſh, or arranging a Subject "already publiſhed on a more methodical Plan; in either "of theſe Caſes he cannot be a proper Judge, unleſs he "has ſeen the Pieces already extant on that Subject." Theſe are juſt Remarks, and how far they have been attended to in the Execution of this Work, I ſhall leave it to the ſkilful Mariner to judge; in the mean time will inform him, with what ſucceſs the Method here purſued, has been attended in my own School.

DIFFERENT Teachers have different Methods, and every one thinks his own the beſt; but that Method muſt be acknowledged ſuperior, which tends to edify the Scholar, and make him Maſter of the Art; "and every "one who has had Experience in teaching, muſt be fully "convinced, that a methodical Manner of delivering any "Science, is the only way of rendering it intelligible, and "that if this be neglected, the Ideas acquired from ſuch a "confuſed Manner of Inſtruction, will at beſt be but faint "and languid*."—To avoid Confuſion, and to convey Inſtruction by an eaſy Method, has been my great aim; and to this end, I have purſued the Form which Mr. HODGSON has uſed in his Syſtem of the Mathematics, for making the Canons or Proportions; by which a Youth may be inſtructed in Half an Hour, how to make them to any Problem in Navigation.

THE Method is at Pages 18, 19, and 20, but our Pupil, prior to this, muſt be taught the Uſes of the Plane Scale, Table of Logarithms, and how to conſtruct thoſe Problems of Geometry, &c. which are at the beginning of the Book, through which he muſt proceed regularly 'till he comes to the Pages before-mentioned; then let him get to know the Names of all the Lines of FIG. p. 18, the References at p. 19, will aſſiſt him; and teach him how to make the Canons as taught in p. 20; upon which the Maſter may enlarge at pleaſure. This Method cannot clog the Memory; (becauſe in any Problem, he will have nothing more to do but draw a rough Sketch of the Figure, mark the Parts given, and then he can eaſily make Canons to find the reſt;)

---

* BARROW's Navigatio Britannica.

and I have found it ſo ſucceſsful, that Youngſters of a moderate Capacity, have been enabled to go through all the Caſes of ſailing, without any further trouble to their Inſtructor.

On this Principle I hope none will condemn me for omitting Trigonometry, which moſt Authors place as introductory to Navigation; to be ſure ſuch as have time may learn it, and I recommend it, eſpecially to thoſe who ſhall be concerned in ſurveying Coaſts, Harbours, &c. But Navigation can be taught without ſuch Introduction, and I think it beſt, when a Perſon's time is limitted to School, as it generally is.

With regard to the Particulars contained in this Work, it would be unneceſſary to Mention them, as they are ſufficiently enumerated in the Table of Contents: only I would obſerve, on my Method of finding the Longitude, that it is the ſhorteſt Method extant, for reducing the obſerved Diſtance of the Moon and Sun, or Moon and fixed Star, to the true; by Logarithm Sines, and Coſines only: yet there is a Circumſtance in it that ſurpriſes me, and that is, it will give a reduced Diſtance when the Obſervations are incorrect; I mean, when they will not conſiſt in a Spherical Triangle, which true Obſervations will always do. Yet the Method is not to be exploded, it has its merits, and will give the Diſtance true to the neareſt Second, when the Obſervations are truly taken. The Methods in the Requiſite Tables, the new Method in Moore's Navigation, and Bettesworth's Method in his Naval Mathematics, are in the ſame Condition; for the iii and iv Examples, at p. 35 and 36 of the firſt Book, and the ii

Example, p. 295, in MOORE's, will not ſolve by the Rules of Spherical Trigonometry.

To conclude, I hope the kind Reader will excuſe the Typographical Errors he may meet with, though the ſtricteſt Attention has been paid to prevent them; and I hope from a peruſal of the Work, he will reap much Inſtruction, which is the earneſt and ſincere Wiſh of

THE AUTHOR.

Goſport, May 24th, 1791.

☞ *GEORGE DIXON:*

Deſires to acquaint thoſe Gentlemen intended for the Sea; and that have a few Weeks to ſpare previous to their going; that he can fit them for conducting a Ship to any Part of the Globe. He alſo teaches the Uſe of Sea Inſtruments, Charts, &c. &c.

CONTENTS.

GEOMETRY.

PAGE.
GEOMETRICAL Definitions — — — 1
Geometrical Problems — — — 3
On Angles — — — — 4
On Triangles — — — — 7
How to work any Canon — — — 9

NAVIGATION.

Nautical Definitions — — — 13
Rules for Latitude — — — 14
Plane Sailing — — — 17
A general Rule for making Canons — — 19
Caſes of Plane Sailing — — — 23
More Examples for Exerciſe — — — 28
Middle Latitude Sailing — — — 29
Rules for Longitude — — — 32
Mercator's Sailing — — — 42
Of Tides — — — — 51
To find the Epact 'till the Year 2000 *by Inſpection* 53
To Eſtimate Diſtances by Sound — — — 59
To Correct Diſtances — — — 60
How to Proportion Log-lines to any Glaſs — — 62

NAUTICAL ASTRONOMY.

Aſtronomical Definitions — — — 65
To Convert Time into Motion — — — 69

To

PAGE.
To find Greenwich Time in any Longitude — 71
To find the Sun's Declination — — 72
To find the Time when the Moon paſſes the Meridian of any Place — — — 74
To find the Moon's Hor. Par. and Semi-diameter — 76
To find the Correction of the Moon's Altitude — 78
Tables of Dip, Sun's Parallax, and Augmentation 79
How to compute the Dip — — — ib.
Table of the Refraction of Heavenly Bodies — 80
To find the Latitude by Meridian Obſervations of the Sun, Moon, and fixed Stars — — 81
To find the Latitude by Double Altitudes — — 88
To Regulate the going of a Watch — — 93
Longitude by the Lunar Obſervation — — 96
Of the Variation of the Compaſs; and how to find it by an Amplitude, and Azimuth — — 104
How to Correct Courſes and Bearings — — 109
On Keeping the Account of a Ship's Voyage — — 115
Rules for correcting the Dead Reckoning — — 118
On Separate Days Works — — — 122
Log of a Ship's Voyage — — — 131
Table of the Sun's Right Aſcenſion — — 143
Right Aſcenſion and Declination of the principal fixed Star — — — — 145
Uſe of the above Tables — — — 147
A Deſcription of Hadley's Quadrant — — 149
Appendix — — — — — 158
Rule for conſtructing a Table of Meridinal Parts — 159
An Accouut of the Magnet — — — 160
On the Azimuth Compaſs; and how to take an Amplitude, Azimuth, and find the Leeway — — 161
Tables of the Sun's Declination for 28 Years — 164
An extenſive and correct Geographical Table — 166

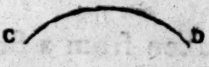
GEOMETRY.

DEFINITIONS.

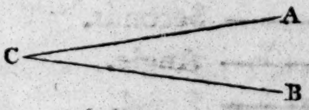
GEOMETRY is a Mathematic Science, explaining the kinds or properties of continued quantity or magnitude: as a Line, a Superficies, and a Solid, whoſe original is from a Point.

2. A Point, is that which is without parts or dimenſions.

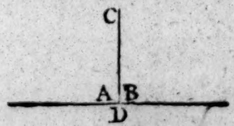
3. A Line, is length without breadth; as A B called a Right Line, and C D a Curved Line.



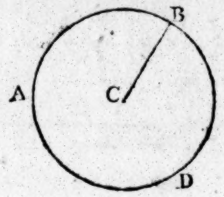
4. A Plane Angle, is the inclination of two lines on the ſame plane, meeting in a point; as A C B, C being the angular point.



5. A Perpendicular, is a right line which cuts another at right angles, or makes equal angles on both ſides; as C D, making equal angles at A and B.



6. A **Circle** is a plane figure, bounded by an uniform Curve Line, called the Circumference, as A B D; which is every where equally diſtant from a point C (about which it was deſcribed) called its Centre.



NOTE.

The Circumference of every Circle is ſuppoſed to be divided into 360 equal parts, called Degrees; each Degree into 60 equal parts, called Minutes; and each Minute into 60 equal parts, called Seconds.

7. **Radius** is any opening of a pair of Compaſſes, by which we deſcribe a Circle, or any Arc thereof, as C B.

Radius taken from a Scale, is either the Chord of 60° Sine 90°, or Tangent 45° which are reſpectively equal,

° ſtands for Degrees.
′ ——— Minutes or Miles.
″ ——— Seconds.
∠ ——— Angle.
= ——— Equal.

GEOME-

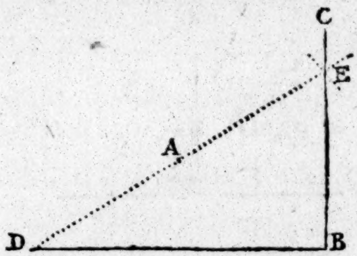
GEOMETRICAL PROBLEMS.

PROBLEM I.

To raiſe a Perpendicular from the end of a given Line D B.

CONSTRUCTION.

Draw D E at pleaſure, then with D A (=A B) deſcribe an Arc at E, through the point of Interſection, draw B C which is the Perpendicular required.

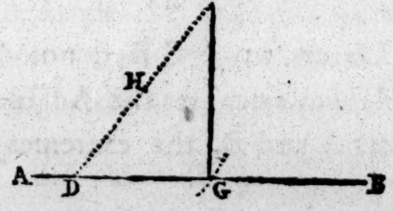


PROBLEM II.

To let fall a Perpendicular from a given Point C, upon a given Line A B.

CONSTRUCTION.

Draw a line C D at pleaſure, which biſect in H, then with the Radius C H or H D cut the given Line A B in G, and draw C G, which is the Perpendicular required.



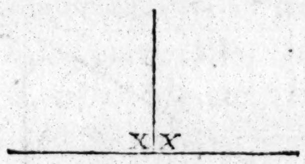
ON

ON ANGLES.

All Angles included between two right lines are called Plane Angles, and fall under one of theſe three denominations, viz:

A Right
An Obtuſe } Angle.
An Acute

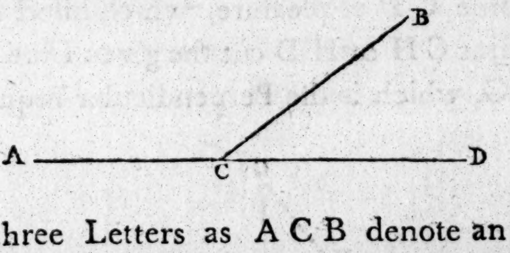
1. A Right Angle containing 90°, is that which is included between two lines, one falling perpendicular upon the other; as X X.



NOTE.

Angles are always eſtimated in Degrees, Minutes, and Seconds.

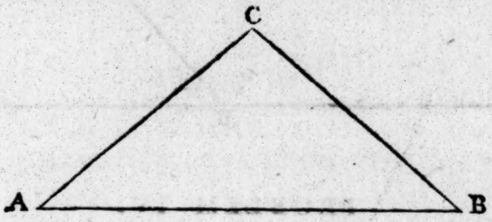
2. An Obtuse Angle is that which is greater than a Right Angle, as A C B.



When three Letters as A C B denote an Angle, the middle Letter C always denotes the Angular Point; and the other two letters A and B, the extremes of the Sides which include it.

3. **An Acute Angle** is that which is leſs than a Right Angle, as B C D.

4. **All Angles** are oppoſite to the ſides that ſubtend them, as the Angle A is oppoſite the ſide B C; the Angle C the ſide A B; and the Angle B to the ſide A C.



5. **The Complement** of an Angle is what it wants of 90°.

6. **The Supplement** of an Angle is what it wants of 180°.

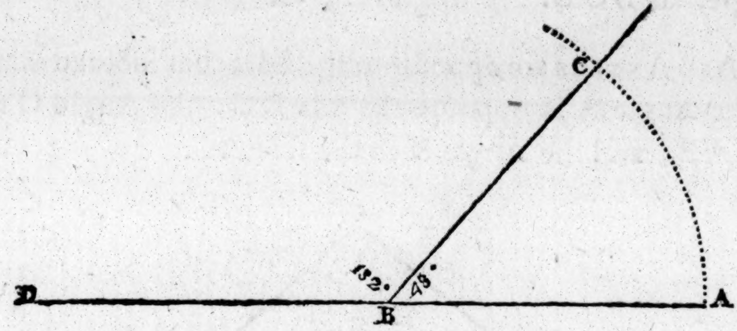
7. **The Logarithm** of an Angle exceeding 90°, is found by ſubtracting the given Angle from 180°. and taking the Logarithm of the remainder.

PROBLEM III.

To make a Plane Angle equal to any number of Degrees, ſuppoſe 48° or 132°.

CONSTRUCTION.

Draw D A at pleaſure, then about B (any point in that line) with the Chord of 60° deſcribe an Arc; upon which ſet off the given Angle 48°, taken from the ſame line of Chords from A to C, and draw B C; then will the Angle C B A contain 48°, and the Angle C B D 132°.

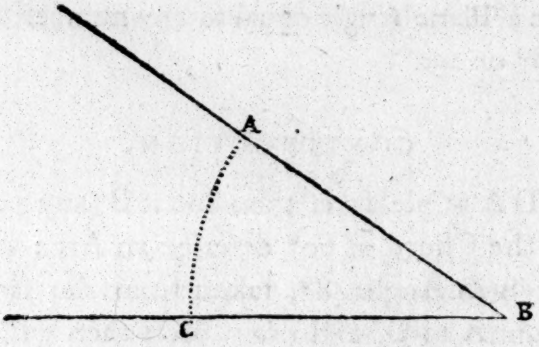


PROBLEM IV.

To meaſure a given Plane Angle A B C.

CONSTRUCTION.

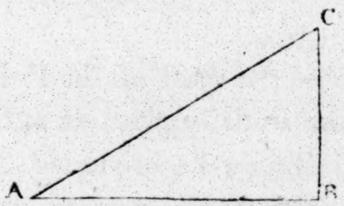
About the Angular Point B, with the Chord of 60°, deſcribe the Arc A C cutting the containing ſides in the Points A and C, then the diſtance A C applied to the Chords, will ſhew the Degrees and Minutes contained in the Angle A B C which here is equal to 33°.30′.



ON TRIANGLES.

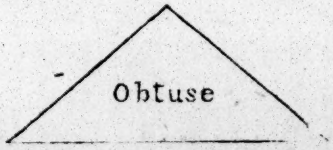
ALL three ſided figures are called Triangles, and are either Right or Oblique Angled.

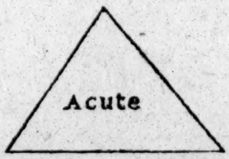
1. A RIGHT ANGLED TRIANGLE is that which has one Right Angle, as at B.



IN this Triangle, the ſide
A B is called the Baſe.
B C ——————— Perpendicular.
A C ——————— Hypothenuſe.

2. AN OBLIQUE ANGLED TRIANGLE is that which has its Angles oblique, and is either obtuſe or acute angled, or both.





3. EVERY Triangle conſiſts of ſix parts, three ſides and three Angles.

4. THE ſides of Triangles are always eſtimated in Feet, Yards, Miles or Leagues, and delineated from a Scale of equal Parts.

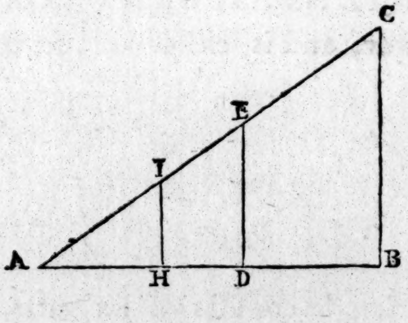
5. THE three angles of every Plane Triangle contain 180°: and if two Angles in a Triangle are given, the third is found by ſubtracting the ſum of the given Angles from 180°.

6. In every Triangle the ſides are proportional to the Sines of their oppoſite Angles.

NOTE.

1. The ſides and Angles given in any Triangle, are always marked with a daſh (′) and thoſe required with a cypher (⊖).

2. The ſolutions of the moſt uſeful Problems in Navigation, and ſuch as are in daily practice at Sea, are contained in the doctrine of a ſingle Right-angled Triangle; in the 4th Prop. Euclid's 6th Book, where it is demonſtrated, "that Triangles which are ſimilar or alike, their like ſides are proportional," thus the Triangles A H I, A D E, and A B C are ſimilar and proportional one to another.



What I call the doctrinal part, or how the proportions are made, will be ſhewn under Plane Sailing; and I recommend that it muſt be perfectly underſtood, before any one can pretend to ſolve a Queſtion in Navigation with any ſatisfaction to himſelf or Teacher.

HOW TO WORK ANY

PROPORTION IN NAVIGATION.

IN ſolving any caſe in Plane, Middle Latitude, or Mercator's Sailing, there muſt be given two Parts beſides Radius, one of which muſt be a ſide; to find a fourth.

2. In Oblique-angled Triangles there muſt be given three things, one of which muſt be a ſide, to find a fourth.

3. When the Proportion or Analogy is made from what is given in the figure, a rough ſketch of which muſt always precede your making the Proportion; proceed to work by Logarithms

THUS,

Take from the Tables the Logarithms anſwering to the three given terms; add the ſecond and third Logarithms together, and ſubtract the firſt from the ſum, the remainder is the Logarithm of the fourth term: then the Number, or Degrees and Minutes anſwering to this Logarithm, is the fourth term required.

OR,

To prevent the labour of Subtraction, the Complement Arithmetical may be uſed, in any Proportion when Radius is not the firſt term, then the ſum of the Co-Ar. and other two Logarithms omiting 10 in the Index, will produce the ſame Logarithm as before.

NOTE.

1. The Complement Arithmetic, is the remainder after any Logarithm is ſubtracted from 10 or 20.

The Co-Ar of any Log. Coſine, is the Log. Secant.

Sine ——— Co-Secant.
Tangent ——— Co-Tang.

and when uſed in any Proportion, omit 10 in the Index.

2. The Characteriſtic or Index placed before the Logarithm of any number, muſt always be an Unit leſs than the number of places in the given abſolute number. It alſo ſhews, how many places the natural number correſponding with any Logarithm doth contain.

3. The Index to Sine Radius 90°, and Tangent Radius 45° is always 10, and the Logarithm all cyphers; but when either Radius is the firſt term in a Proportion, the Index and Logarithm are cyphers.

ON
NAVIGATION.

DEFINITIONS.

NAVIGATION is the art of conducting a Ship from one Port to another, and that either in coaſting along Shore, or in croſſing the wide and pathleſs Ocean to the remoteſt parts of the World. In order to which, the Navigator, muſt be able at all times, to find the Courſe and Diſtance from one Place to another; and to determine the Place of the Ship every Day, what Courſe he muſt ſteer, and how far, to gain his intended Port.

A SHIP's Place at Sea is determined from her Latitude and Longitude.

THE EQUATOR called by Seamen the Line, is a great Circle, lying equally diſtant between each Pole, dividing the Earth into two equal Parts; that towards the North Pole, is called the Northern Hemiſphere, and that towards the South, the Southern Hemiſphere.

MERIDIANS are imaginary Circles paſſing from one Pole to the other, and cutting the Equator at Right Angles: in the Plane and Mercator's Charts, they are repreſented by right lines drawn North and South.

LATITUDE is the diſtance of a Place from the Equator, reckoned in Degrees and parts of a Degree on a Meridian.

ON the North ſide of the Equator, it is North Latitude; and on the South ſide it is South Latitude.

As Latitude begins at the Equator where it is nothing, ſo it ends at the Poles, where the Latitude is greateſt, or 90°.

DIFFERENCE of Latitude is an Arc of a Meridian, or the leaſt diſtance between the parallels of two Places, ſhewing how far one of them is to the Northward or Southward of the other.

DIFFERENCE of Latitude can never exceed 180°.

LONGITUDE of any Place, is its diſtance from ſome fixed Meridian, as Greenwich, Paris, &c. reckoned upon the Equator in Degrees Eaſt and Weſt; until it comes to the oppoſite Meridian, and can never exceed 180°.

DIFFERENCE of Longitude is an Arc of the Equator, intercepted between the Meridians of two Places, ſhewing how far one of them is to the Eaſtward or Weſtward of the other.

RULES FOR LATITUDE.

CASE I.

THE Latitudes of two Places given; required their difference of Latitude.

RULE.

IF the Latitudes are of the ſame name, ſubtract the leſs from the greater; but if of contrary names, take their ſum for the difference of Latitude required.

EXAMPLES.

WHAT is the difference of Latitude between the Lizard and Barbadoes?

Liz-

	°	'	
Lizard's Latitude	49.	58	N.
Barbadoes' Latitude	12.	58	N.
Diff. Latitude	37.	—	
	60		
	2220 Miles.		

A Ship from the Latitude of 7°. 41' S. ſails directly North to the Latitude of 2°. 27' N, required the difference of Latitude?

	°	'	
Latitude from	7.	41	S.
Latitude in	2.	27	N.
Diff. Latitude	10.	8.	
	60		
	608 Miles.		

CASE II.

Given the Latitude ſailed from, and the difference of Latitude, required the Latitude come to.

RULE.

If the given Latitude and difference of Latitude, are of the ſame name, their ſum is the Latitude of the ſame name; but if they have contrary names, their difference is the Latitude of the ſame name with the greater.

EXAMPLES.

A Ship from Latitude 24°. 17' N, ſails Northward 'till her difference of Latitude is 7°. 14' required her preſent Latitude?

Latitud

	° '
Latitude ſailed from	24. 17 N.
Diff. Latitude	7. 14 N.
Preſent Latitude	31. 31. N.

A Ship from Latitude 50°. 41' N. ſails Southward 'till her difference of Latitude is 647 Miles. What Latitude is ſhe come to?

	° '
Latitude ſailed from	50. 41 N.
Diff. Latitude 647'=	10 47 S.
Latitude come to	39. 54 N.

A Ship ſails Northward, from a Port in Latitude 5°. 41' S. 'till her difference of Latitude be 341 Miles. What is her preſent Latitude?

	°
Latitude left	5. 41 S.
Diff. Latitude 341' =	5. 41 N.
Preſent Latitude	0. 0

The Ship being upon the Equator; where ſhe will ſee both Poles in the Horizon, diametrically oppoſite each other.

A Ship from Latitude 2°. 17' N. ſails Southward, 'till her difference of Latitude is 700 Miles. What is the preſent Latitude of the Ship?

	° '
Diff. of Latitude 700' =	11. 40 S.
Latitude left	2. 17 N.
Preſent Latitude	9. 23 S.

The Ship having croſſed the Equator.

Of

OF PLANE SAILING.

PLANE SAILING is the art of navigating a Ship, upon principles deduced from the notion of the Earth being an extended Plane.

A RHUMB LINE is a right line, drawn from the centre of the compaſs to the Horizon; and derives its name from that Point of the Compaſs it falls in with.

THE COURSE is an Angle, which any Rhumb Line makes with the Meridian; and is ſometimes reckoned in Degrees, and ſometimes in Points of the Compaſs.

DISTANCE, is the number of Miles or Leagues a Ship has run on a Rhumb, or direct Courſe in a given Time.

DEPARTURE or Meridianal diſtance, is the Eaſt or Weſt diſtance of a Ship from the Meridian of a given Place; reckoned on its parallel in Miles. In the Plane Chart it is the ſame as difference of Longitude.

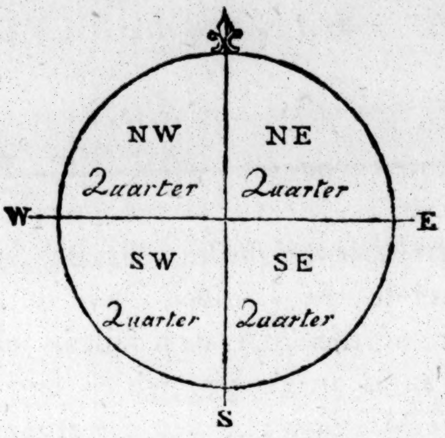
NAUTICAL OBSERVATIONS.

1. IF a Ship ſails on a Meridian ſhe makes no departure, and her diſtance and difference of Latitude are the ſame.

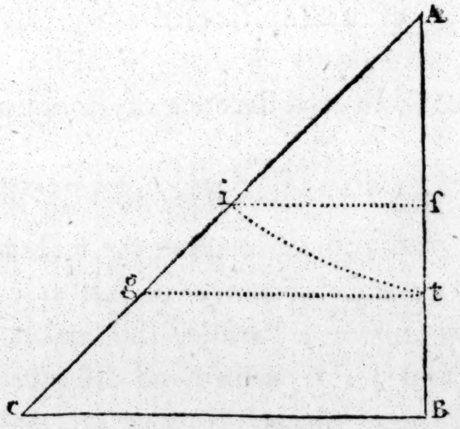
2. IF a Ship ſails on a Parallel ſhe makes no difference of Latitude, and her departure and diſtance are the ſame.

3. IN all Proportions of Navigation, make the upper part of your Slate or Book North, then the right ſide is Eaſt, the left Weſt, and the bottom South.

THE following figure repreſents the four Quarters of the Compaſs; and if a Ship ſails in the N. E. Quarter, her difference of Latitude is North, and departure E. but if ſhe ſails in the S. W. Quarter, her difference of Latitude is S. and departure W. &c. of the other Quarters.



THE annexed figure repreſents a Ship ſailing in the S. W. Quarter.



Where A is the Place ſailed from.
C the Place arrived at.
Then A C is the Diſtance run.
A B is the difference of Latitude.
B C is the Departure.
∠ C A B is the Courſe.

REFER-

REFERENCES.

The Part or Right Line
A i repreſents the Sine Radius.
s i is the Sine } of the Courſe.
A s is the Coſine } of the Courſe.
A t repreſents the Tangent Radius.
t g is the Tangent } of the Courſe.
A g is the Secant } of the Courſe.

NOTE.

These things will be alike repreſented, when the Ship ſails in any other quarter of the Horizon.

A GENERAL RULE,

Applicable to the Numeral Solution of any Caſe in Single Courſes.

When a Side and Courſe are given, to find the reſt; it will be, as a part upon the given Side, is to a part on the Side required; ſo is the given Side to the Side required. And the contrary, when two Sides are given to find the Courſe.

NOTE.

When two Sides are given to find the Courſe, begin with that Side which has Radius upon it: and when two Sides are given to find a third, find the Courſe firſt.

ILLUSTRATION.

Suppose the difference of Latitude A B, and the Courſe were given, to find the Departure B C; it would be.

As A ſ a part on the given ſide A B.
: ſ i a part on the Side required, *i. e.* B C.
: : A B the given Side.
: B C the Side required.

i. e.

As Coſine of the Courſe.
: Sine of the Courſe.
: : Difference of Latitude.
: The Departure.

AGAIN,

Suppose the difference of Latitude and Departure were given, to find the Courſe; it would be.

As A B Difference of Latitude.
: B C the Departure.
: : A t a part on the Side A B.
: t g a part on the Side B C.

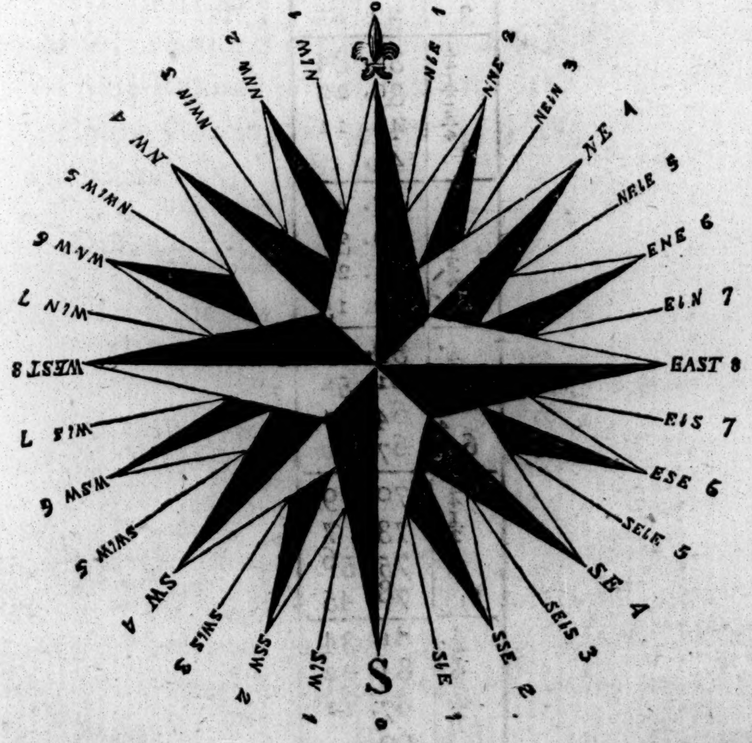
i. e.

As Difference of Latitude.
: Departure.
: : Tangent Radius.
: Tangent Courſe.

After the ſame manner may all the Caſes in Parallel Middle Latitude and Mercator's Sailing be reſolved; though the Caſes in Middle Latitude Sailing, may be done more briefly by the Solution of an Oblique Triangle.

The Mariner's Compass is a circular Card, artificially repreſenting the Horizon of every Place; being divided into 32 equal parts called Points; and is ſo conſtructed by the help of a Magnetical Needle, that in every Place, the North Point of the Card ſhews the poſition of the Meridian in that Place; and hence it is eaſy to keep a Ship on any propoſed Rhumb thereof. But the Needle is ſubject to Variation, from circumſtances unknown and conſequently the North Point of the Card from the true North Point of the Horizon: hence the abſolute neceſſity of knowing the Variation of the Compaſs every Day, in order to correct the Courſes a Ship has ſteered.

The CARD.



A TABLE

A TABLE of the ANGLES,
WHICH EVERY QUARTER POINT OF THE COMPASS, MAKES WITH THE MERIDIAN.

PTS.	D.	M.
¼	2.	49
½	5.	37
¾	8.	26
1	11.	15
¼	14	4
½	16.	52
¾	19.	41
2	22.	30
¼	25.	19
½	28.	7
¾	30.	56
3	33.	45
¼	36.	34
½	39.	22
¾	42.	11
4	45.	
¼	47.	49
½	50.	37
¾	53.	26
5	56.	15
¼	59.	4
½	61.	52
¾	64.	41
6	67	30
¼	70.	19
½	73.	7
¾	75.	56
7	78.	45
¼	81	34
½	84.	22
¾	87.	11
8	90.	

NOTE.

Before the Learner begins the following Caſes, he muſt be well acquainted with the Compaſs and the above Table; ſo as to readily tell how many Points every Rhumb is diſtant from the Meridian, with the correſponding Degrees and Minutes.

CASE I.

Given the Courſe ſteered, and Diſtance run; required the difference of Latitude.

EXAMPLES.

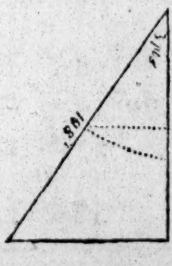
1. A Ship from Latitude 44°. 41′ N. ſails S W by S. 108 Miles; required her preſent Latitude?

As Sine Radius 90° = 0.
: Coſine Courſe 33°. 45′ = 9.91985
: : Diſtance 108′ = 2.03342

: Diff. Lat. 89.8 = 1.95327

Latitude left 44°. 41′ N.
Diff. Lat. 90′ = 1°. 30′ S.

Latitude in 43°. 11′ N.



By Traverſe Table.

Find the Courſe 3 Points at the top of the Table, and againſt the Diſtance 108 in the column of Diſtances, ſtands the difference of Latitude 89.8 Miles.

2. A Ship from Latitude 40°. 40′ S. ſails N N W $\frac{3}{4}$ W 240 Miles. What Latitude is ſhe arrived at?

Anſ. Preſent Latitude 37°. 14′. S.

3. A Ship from a Port in Latitude 1°. 14′ N. ſails S E by E. 170 Miles. What is her preſent Latitude?

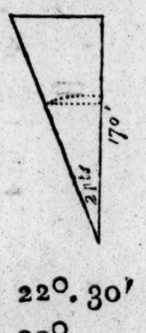
Anſ. Preſent Latitude 20′ *S. the Ship having croſſed the Equator.*

CASE II.

Given the Courſe ſteered and difference of Latitude, required the Diſtance run.

EXAMPLES.

If a Ship ſails N N W till her difference of Latitude be 170 Miles. What Diſtance has ſhe run?



As Coſine Courſe 22°. 30′ = 0. 03439
: Sine Radius 90° = 10.
: : Diff. Lat. 170′ = 2. 23045

: Diſtance 184′ = 2. 26484

By Traverſe Table.

At top, find the Courſe N N W. or two Points, and againſt 170, the Difference of Latitude in its Column; you will find 184 Miles in the Column of Diſtances.

2. A Ship from Latitude 1°, 18′ N. ſails S W ¾ W. into the Latitude of 1°. 10° S. What Diſtance did ſhe run?

Anſ. 248.4 Miles.

3. A Ship ſails N E by N ½ E. from Latitude 40° N. into 41°. 18′ N. Required her Diſtance run?

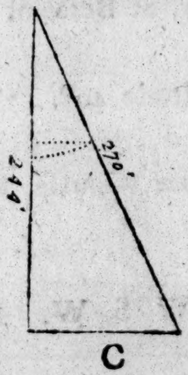
Anſ. 101 Miles.

CASE III.

Given the Diſtance and Difference of Latitude; required the Departure.

EXAMPLES.

Suppose a Ship ſails between the S and E. until her Diſtance be 270′. and her Difference of Latitude 244′. Required her Courſe and Departure?



To find the Courſe.

As Diſtance 270′ = 7. 56864
: Diff. Latitude 244′ = 2. 38739

: : Radius 90° = 10.

: Coſine Courſe 25°. 21′ = 9.95603
or S. 25°. 21′ E.

To find the Departure.

As Coſine Courſe 25°. 21′ = 0. 04397
: Sine Courſe 25°. 21′ = 9. 63160
: : Diff. Lat. 244′ = 2. 38739

: Departure 115°. 6 = 2. 06296

By Traverſe Table.

SEEK in the Table till the Diſtance and Difference of Latitude correſpond in their reſpective Columns, againſt which you will find the Departure in its Column; which if leſs than the Difference of Latitude, the Courſe ſtands at Top; but if greater, at Bottom.

2. A SHIP from Latitude 40°. 17′ N. ſails in the S W. Quarter 268 Miles, and then finds herſelf in Latitude 38°. 34′ N. Required her Courſe ſteered, and Departure from the Meridian?

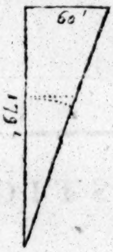
Anſ. Courſe W S W. Departure 247.4 Miles.

CASE IV.

Given the Difference of Latitude and Departure.— Required the Courſe and Diſtance.

EXAMPLES.

A Ship from Latitude 40°. 17′ N. is arrived in Latitude 43°. 16′ N. and has got 60 Miles to the Eaſtward of her departed Meridian. What Courſe did ſhe ſteer, and what is her direct Diſtance run?



To find the Courſe.

As Diff. Lat. 179′ = 7.74715
: Departure 60′ = 1.77815
: Tang. Radius 45° = 10.
: Tang. Courſe 18°. 32′ = 9.52530, or N 18°. 32′ E.

To find the Diſtance.

As Sine Courſe 18°. 32′ = 0.49777
: Sine Radius 90′ —— = 10
: Departure 60′ = 1.77815
: Diſtance 188.8′ = 2.27592

By Traverſe Table.

WITH the given Difference of Latitude and Departure ſeek in the Table, againſt which you will find the Diſtance, and the Courſe will be found as in the laſt Caſe.

2. A SHIP from Latitude 48°. 32′ N. ſails between the N and W. until her Departure is 54′, and then finds herſelf in Latitude 49°. 54′ N. What Courſe did ſhe ſteer and what Diſtance has ſhe run?

Anſ. Courſe ſteered NW by N. Diſtance 98.18 Miles.

QUESTIONS

TO EXERCISE THE PRECEDING CASES.

1. A SHIP from Latitude 40°. 18′ N. ſails N W by W. 400′. Required the Ships preſent Latitude, and Departure from the Meridian?

Anſ. Preſent Lat. 44° N. Departure 332.6 Miles.

2. ADMIT a Ship ſails from Latitude 17°. 48′ N. S S E $\frac{1}{2}$ E. until by Obſervation ſhe be in 14°. 54′ N. Latitude. I demand the Diſtance run, and Departure?

Anſ. Diſtance 197.3′.—Departure 92.97 Miles.

3. A SHIP ſails S W $\frac{1}{2}$ W. till ſhe departs her Meridian 248′. Required her Diſtance run, and Difference of Latitude?

Anſ. Diſtance 320·9′.—Diff. Latitude 203·6′.

4. A SHIP

4. A Ship from Latitude 49°. 50′ N. ſails 300 Miles in the N W Quarter, when ſhe finds her Departure to be 170′. Required the Courſe ſteered, and preſent Latitude of the Ship?

Anſ. Courſe N 34°. 31′ W. Latitude 53°. 57′ N.

5. A Ship in the S W Quarter ſails 170 Miles, and then finds ſhe has made 84 Miles of ſouthing. Required the Courſe ſteered and Departure?

Anſ. Courſe S 60°. 23′ W. Departure 147.8 Miles.

6. Yesterday Noon we were in Latitude 41°. 30′ S. and this Day Noon we are in Latitude 43°. 18′ S. and have got 240 Miles to the Weſtward of our departed Meridian. Required the Courſe ſteered, and Diſtance run?

Anſ. Courſe S 65°. 46′ W. Diſtance 263 Miles.

Note. After the Pupil is made perfect in Plane Sailing; and his time at School be ſhort, let him be taught the Rules for Longitude, p. 32. and initiate him into Mercator's Sailing immediately.

MIDDLE LATITUDE SAILING.

Middle Latitude Sailing is a method of finding a Ship's place on the Globe, by the principles of Plane and Parallel Sailing jointly.

Parallel Sailing teacheth what Diſtance a Ship ſhould run due Eaſt or Weſt, in ſailing from the Meridian of one Place to that of another on any Parallel; and is generally uſed in conducting a ſhip to an Iſland, remote from the main Land; by firſt ſailing to the parallel of Latitude the Place is in, and then running due E or W. according as the Place lays from you; when you will be ſure to make the Longitude required, and conſequently your deſtined Port.

Middle Latitude Sailing, tho' it is not ſo ſtrictly true as Mercator's, may be relied on for working any Day's Work; and with great facility by the Traverſe Table alone.

In this ſailing, the Departure is reckoned as a Meridianal Diſtance in that Latitude, which is a Middle parallel between the Latitude ſailed from, and the Latitude come to: But in high Latitudes this Diſtance will be too great, becauſe the Meridians converge towards the Poles: yet if the parallels are near the Equator, or not far diſtant from one another in any Latitude, the Error becomes ſo ſmall, as not to affect the nautical Concluſions drawn from ſuch Suppoſition.

Figure for Parallel Sailing.

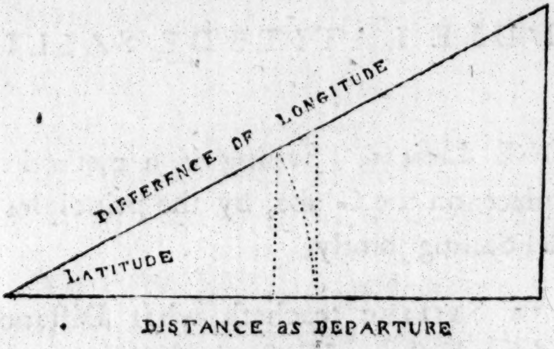
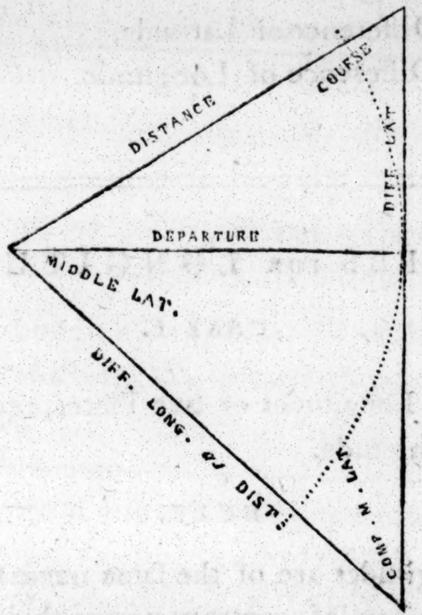


Figure for Middle Latitude Sailing.



To find the Middle Latitude.

RULE.

WHEN the Latitudes are of the ſame name, half their ſum will be the Middle Latitude ; but when of contrary names, half their difference is the Middle Latitude required.

To find the Courſe.

As Difference of Latitude.
: Difference of Longitude.
: : Coſine Middle Latitude.
: Tangent Courſe.

To find the Difference of Longitude.

As Coſine Middle Latitude.
: Tangent Courſe.
: : Difference of Latitude.
: Difference of Longitude.

RULES FOR LONGITUDE.

CASE I.

GIVEN the Longitudes of two Places, required the Difference of Longitude.

RULE.

If the Longitudes are of the ſame name take their Difference, but when of contrary names their Sum, for the Difference of Longitude: and when the Sum exceeds 180°. take it from 360°; the remainder will be the requird Difference of Longitude.

EXAMPLES.

What is the Difference of Longitude between Portſmouth and the Lizard?

	°	'	
Longitude Lizard	5.	15	W.
Longitude Portſmouth	1.	6	W.
Diff. Longitude	4.	9	
	60		
	249 Miles.		

What is the Difference of Longitude between Portſmouth and Minorca?

	°	′	
Longitude Portſmouth	1.	6	W.
Long. Minorca	3.	49	E.
Diff. Longtitude	4.	55.	
	60		
	295 Miles.		

A Ship in Longitude 147°. 41′ E. is bound to a Place in Longitude 164°. 44′ W. What Difference of Longitude muſt ſhe make?

	°	′	
Ship's Longitude	147.	41	E.
Long. bound to	164.	44	W.
	312.	25	
	360.		
Diff. Longitude	47.	35	

CASE II.

Given the Longitude failed from, and the Difference of Longitude; required the preſent Longitude of the Ship.

RULE.

If the Longitude left, and Difference of Longitude, are of contrary Names; their difference is the Longitude of the ſame Name with the greater. But if the given Longitude and Difference of Longitude, are of the ſame Name, their ſum is the Longitude of the ſame Name with the given Place.—If the ſum is greater than 180°. take it from 360°, and the remainder is the Longitude required of a contrary name with that of the given Place.

EXAMPLES.

A Ship from the Lizard ſails W. till her Difference of Longitude be 460 Miles. Required her preſent Longitude?

		°	'	
Lizard's Longitude		5.	15	W.
Diff. Long. 460′	=	7.	40	W.
Preſent Long.		12.	55	W.

A Ship from 1°. 18′ E. Longitude, ſails Weſtward till her Difference of Longitude is 174 Miles. What Longitude is ſhe in?

		°	'	
Longitude ſailed from		1.	18	E.
Diff. Long. 174′	=	2.	54	W.
Longitude in		1.	36	W.

A Ship from Longitude 164°. 17′ E. ſails Eaſtward until ſhe differs her Longitude 41°. 40′. Required her preſent Longitude?

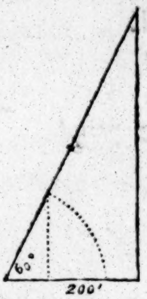
Anſ. Preſent Long. 154°. 3′ W.

CASE III.

Given the Longitude ſailed from, and Diſtance run upon a given Parallel; required the preſent Longitude.

EXAMPLES.

A Ship from Latitude 60° S. ſails Weſtward 200 Miles. Required her Difference of Longitude?



As Coſine Latitude 60° = 0. 30103
: Sine Radius 90° = 10.
: : Diſtance 200' = 2. 30103

: Diff. Long. 400' = 2. 60206

A Ship from Latitude 40°. 17' N. Longitude 41°. 40' W. ſails Weſt 278 Miles. Required her preſent Longitude?

Anſ. Preſent Long. 47°. 44' W.

A Ship in Latitude 47°. 25' S. Longitude 64°. 49' E. is bound to a Place 174 Miles to the Weſt. Required the Longitude of that Place?

Anſ. Longitude 60°. 31' E.

PROBLEM I.

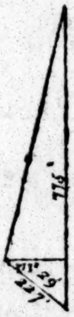
Given the Latitudes and Longitudes of two Places, required the Courſe and Diſtance from one Place to the other.

EXAMPLES.

EXAMPLES.

What is the Courſe and Diſtance between the Lizard and Cape Saint Vincent?

	° '		° '
Lat. Lizard	49. 57 N.	Longitude	5. 15 W.
Lat. Cape	37. 2 N.	Longitude	9. 2 W.
Diff. Lat.	12. 55 = 775'	Diff. Long.	3. 47
			60
Sum Lats.	86. 59		
			227 Miles.
Middle Lat.	43. 29		



To find the Courſe.

As Diff. Lat. 775' = 7. 11070
: Diff. Long. 227' = 2. 35603
: : Coſ. M. Lat. 43°. 29' = 9 86068

: Tang. Courſe S 12° W. = 9. 32741

NOTE.

Having found the Courſe, it is neceſſary in the next Place to know what Quarter of the Compaſs it is in; which may be done as follows.

1. If you are to ſail from a greater North Latitude to a leſs, or from a leſs South Latitude to a greater, you muſt ſail to the Southward.

2. If you are to ſail from a greater South Latitude to a leſs, or from a leſs North Latitude to a greater, you muſt ſail to the Northward.

3. If you are to ſail from a greater Eaſt Longitude to a leſs, or from a leſs Weſt Longitude to a greater, or from Eaſt Longitude into Weſt, you muſt ſail to the Weſtward.

4. But if you are to go from a greater Weſt Longitude to a leſs, or from a leſs Eaſt Longitude to a greater, or from weſt Longitude into Eaſt, you muſt ſail to the Eaſt.

To find the Diſtance.

As Sine Courſe	12°	=	0. 68212
: Coſ. M. Lat.	43°. 29′	=	9. 86068
: : Diff. Long.	227′	=	2. 35603
: Diſtance	792.2′	=	2. 89883

By Traverſe Table.

With the Complement M. Latitude among the Degrees, and Difference of Longitude in the Column of Diſtances, find the Departure ; with which and the Difference of Latitude find the Courſe and Diſtance.

What is the Courſe and Diſtance from Oporto, Latitude 41°. 10′ N. Longitude 8°. 27′ W. to Madeira, Lat. 32°. 38′ N. Longitude 17°. 6′ W.

Anſ. Courſe S 39°. 2′ W. Diſtance 659 Miles.

PROBLEM II.

Given one Latitude, Courſe, and Diſtance; required the other Latitude and Difference of Longitude.

EXAMPLES.

A Ship from Latitude 50°. 40′N. Longitude 40°. 25′W. ſails N W by W. 120 Miles. Required the preſent Latitude and Longitude of the Ship?

To find the Difference of Latitude.

As Radius 90° = 0.
: Coſine Courſe 56°. 15′ = 9. 74474
: : Diſtance 120′ = 2. 07918

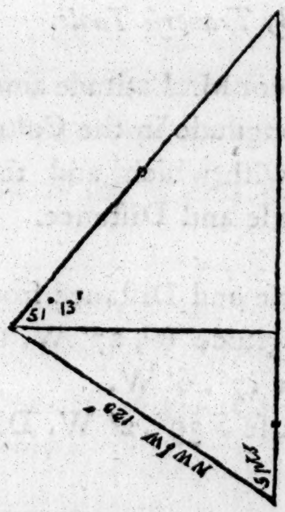
: Diff. Lat. 66. 67′ = 1. 82392

Latitude left ° ′ 50. 40 N.
Difference Lat. 66′ = 1. 6 N.

Preſent Lat. 51. 46 N.

Sum Latitudes 102. 26

Middle Latitude 51. 13



To find the Difference of Longitude.

	° ′		
As Coſ. M. Lat.	51. 13	=	0. 20316
: Sine Courſe	56. 15	=	9. 91985
: : Diſtance	120	=	2. 07918
: Diff. Long.	159. 3	=	2. 20219

		° ′
Longitude left		40. 25 W.
Diff. Long. 159′	=	2. 39 W.
Preſent Longitude		43. 4 W.

By Traverſe Table.

WITH the Courſe among the Points, and Diſtance in its Column, find the difference of Latitude and Departure: then find the Middle Latitude, with which and the Departure in its Column, find the Difference of Longitude in the Column of Diſtances.

2. A SHIP from Cape Clear in Ireland, Latitude 51°.18′ N. Longitude 9°. 10′ W. ſails S E by E 270 Miles. Required the preſent Latitude and Longitude of the Ship ?

Anſ. Latitude 48°. 48′ N. Longitude 3°.20′ W.

3. A SHIP takes her Departure from a Place in Latitude 40° N. Longitude 1°. 18′ E. and ſails S W by W. 400 Miles. Required her preſent Latitude and Longitude?

Anſ. Latitude 36°. 18′ N. Long. 6°. 8′ W.

4. A Ship from Latitude 2°. 18′ S. Longitude 178°.48′ E. ſails E N E ¼ E. 799 Miles. What is her preſent Latitude and Longitude?

Anſ. Latitude 56′ N. Longitude 168°. 17′ W.

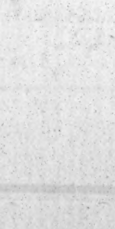
PROBLEM III.

To Work a Day's Work by Middle Latitude Sailing; or, *given the Difference of Latitude and Departure. Required the Courſe, Diſtance, and Difference of Longitude?*

EXAMPLES.

A Ship from Latitude 37° N. Longitude 48°, 20′ W. ſails between the N and E till ſhe finds herſelf in Latitude 51°. 18′ N. and has made 564 Miles of Departure. Required her direct Courſe, Diſtance run, and preſent Longitude?

	° ′		° ′
Departed Latitude	37. —N.		37. —
Preſent Latitude	51. 18 N.		51. 18
Diff. Latitude	14. 18		2)88. 18
	60		
		Middle Latitude	44. 9
	858 Miles		



To find the Courſe.

As Diff. Latitude 858′ = 7.06651
: Departure 564′ = 2.75128
: : Radius 45° = 10.
: Tang. Courſe N 33°. 19 E = 9.81779

To find the Diſtance.

As Sine Courſe 33°. 19′ = 0.26022
: Radius 90° = 10.
: : Departure 564′ = 2.75128
; Diſtance 1027′ = 3.01150

To find the Difference of Longitude.

As Coſine M. Latitude 44°. 9′ = 0.14417
: Radius 90° = 10.
: : Departure 564′ = 2.75128
: Diff. Longitude 786′ = 2.89545

Departed Longitude 48°. 20′ W.
Diff. Longitude 786′ = 13. 6 E.
Preſent Longitude 35. 14 W.

By Traverſe Table.

WITH the Difference of Latitude and Departure, find the Courſe and Diſtance; then with the Comp. M. Lat. and Departure in its Column; find the difference of Longitude in the Column of Diſtances.

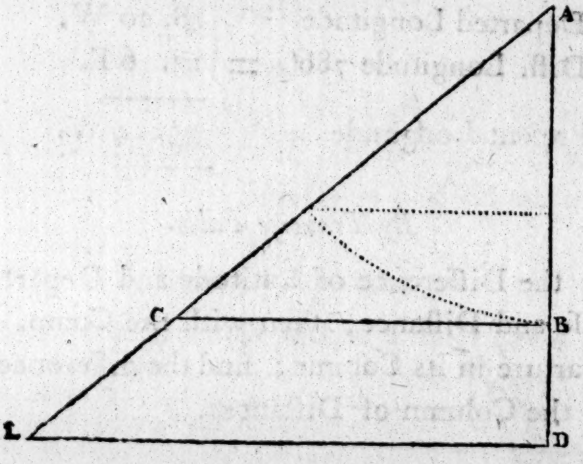
A Ship from Latitude 10°. 44′ N. Longitude 24°. 31′ E. ſails upon an unknown Courſe in the S W Quarter, until ſhe finds herſelf in Latitude 1°. 14′ S. and has only made 200 Miles of Departure. Required the preſent Longitude of the Ship, and Courſe and Diſtance ſailed?

Anſ. Courſe S 15°. 34′ W. Diſtance 745·3′
Longitude 27°. 52′ W.

ON

MERCATOR's SAILING.

THIS Method of Sailing which is truly Globular, is the Art of finding a Ship's Place at Sea, by the aſſiſtance of a Chart conſtructed on Globular Principles, or a Table of Meridianal Parts calculated for that purpoſe.



In this Figure,

A B is called the proper diff. Latitude B C is the Departure A C is the Diſtance run	according to Plane Sailing.

Then,

A D is the Meridianal diff. Lat. D L is the difference of Longitude	per Mercator's Sailing.

To find the Meridianal Difference of Latitude.

RULE.

WHEN the Latitudes are of the ſame Name, ſubtract their correſponding Meridianal Parts: but if of contrary Names add the Meridianal Parts, for the Meridianal difference of Latitude required.

☞ Rules for Longitude come next, ſee P. 32. if Middle Latitude ſailing was omitted.

PROBLEM I.

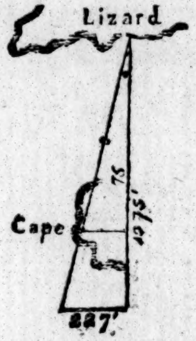
GIVEN the Latitudes and Longitudes of two Places; required their Bearing and Diſtance.

THIS Caſe ſhould be well underſtood, becauſe of its general uſe at Sea, in finding the Courſe and Diſtance from Place to Place; or the Bearing and Diſtance of any Place from the Ship at any Time.

EXAMPLES.

WHAT is the Courſe and Diſtance between the Lizard and Cape Saint Vincent?

	° ′			° ′
Lat. Lizard	49. 57 N. =	3470	Lizard's Long.	5. 15 W.
Lat. Cape	37. 2 N. =	2395	Cape's Long.	9. 2 W.
	12. 55	1075 Mer. D. Lat.		3. 47
	60			60
Prop. D. Lat.	775 Miles.		Diff. Long.	227 Miles.



To find the Courſe.

As Meridian diff. Latitude 1075 = 6. 96859
: Difference Longitude 227′ = 2. 35603
: : Radius 45° = 10.

: Tangent Courſe S 11°. 56′ W. = 9. 32462

To find the Diſtance.

As Coſine Courſe 11°. 56′ = 0. 00949
: Radius 90° = 10.
: : Proper Diff. Lat. 775′ = 2. 88930

: Diſtance 792. 1′ = 2. 89879

By

By Inſpection.

WITH the Mer. Diff. Latitude as proper Diff. Latitude and difference of Longitude as Departure, find the Courſe; then with the Courſe and proper Diff. Latitude find the Diſtance.

2. WHAT is the Courſe and Diſtance from Portſmouth Latitude 50°. 47′N. Longitude 1°. 6′ W. to Dieppe, Latitude 49°. 55′ N. Longitude 1°. 4′ E?

Anſ. Courſe S 58°. 4′ E. Diſtance 98.31 Miles.

3. REQUIRED the Courſe and Diſtance from the Iſland Bonaviſta, Latitude 16°. 6′ N. Longitude 22°. 47′ W. to the Cape of Good Hope, Latitude 34°. 29′ S. Longitude 18°. 23′ E?

Anſ. Courſe S 37°. 47′ E. Diſtance 3840 Miles.

PROBLEM II.

GIVEN the Place ſailed from, and Courſe and Diſtance run. Required the Ship's preſent Place.

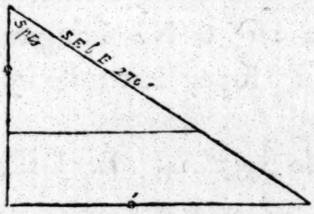
EXAMPLES.

A SHIP from Cape Clear in Ireland, Latitude 51°. 18′N. Longitude 9°. 10′W. ſails SE by E 270 miles. Required her preſent Latitude and Longitude?

To find the Difference of Latitude.

As Radius	90°	=	0.
: Coſine Courſe	56.15′	=	9.74474
:: Diſtance	270′	=	2.43136
: Diff. Latitude	150′	=	2.17610

Departed Latitude		51°18′ N.	=	3598
Diff. Lat. 150′	=	2. 30 S.		
Preſent Latitude		48. 48 N.	=	3364
		M. D. Lat.		234 Miles.



To find the Difference of Longitude.

As Radius	45°	=	0
: Tang. Courſe	56. 15′	=	10.17511
:: M. D. Lat.	234′	=	2.36922
: Diff. Long.	350.2′	=	2.54433
Longitude left			9°10′ W.
Diff. Long.	350′	=	5. 50 E.
Preſent Long.			3. 20 W.

By Inſpection.

WITH the Courſe and Diſtance, find the Difference of Latitude; hence the preſent Latitude and Meridianal

Difference of Latitude. Then, with the Courſe, and Mer. Diff. Latitude in the Column of Latitude, find the correſponding Departure, which is the Difference of Longitude.

2. A Ship from the Lizard, Latitude 49°57′ N. Long. 5°14′ W. Sails WSW ½ W. 214 Miles. What is her Latitude and Longitude arrived at?

Anſ. Latitude 48°55′ N. Long. 10°30′ W.

3. Yesterday Noon we were in Latitude 50°18′ S. Long. 179°41′ E. and we have ſailed till this Day Noon on a direct Courſe NE by E ¾ E. 238 Miles. Required the Ship's Place?

Anſ. Latitude 48°36′ S. Longitude 174°47′ W.

4. Yesterday Noon, by Obſervation we were in Lat. 61°20′ N. Longitude 171°14′ W. and have ſailed till this Day Noon E by N ¼ E. 228 Miles, in a Current ſetting NE ½ E. at the Rate of 1½ Miles an Hour. Required the preſent Latitude and Longitude of the Ship?

Anſ. Latitude 62°16′ N. Longitude 162°23′ W.

PROBLEM III.

To Work a Day's Work by Mercator's Sailing: or, given the Difference of Latitude and Departure, required the Courſe, Diſtance, and Difference of Longitude.

EXAMPLES.

A Ship from Latitude 41°21′ N. Longitude 89°6′ E. ſails in the NE. Quarter till her Difference of Latitude is 72 Miles, and the Departure 54 Miles. Required her Courſe and Diſtance, and preſent Longitude?

To find the Courſe.

As Diff. Latitude 72′ = 8.14267
: Departure 54′ = 1.73239
:: Tang. Radius 45° = 10.
: Tang. Courſe 36°52′ = 9.87506 or N.36°52′E.

To find the Diſtance.

As Sine Courſe 36°.52′ = 0.22188
: Radius 90° = 10.
: : Departure 54′ = 1.73239
: Diſtance 90′ = 1.95427

To find the Difference of Longitude.

Latitude left 41°.21′N. = 2729
Diff. Latitude 72′ = 1°.12′N.

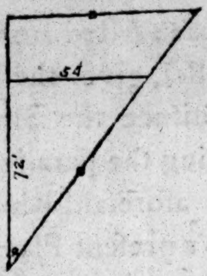
Preſent Latitude 42°.33′N. = 2826

Mer. Diff. Lat. 97

As Proper Diff. Lat. 72′ = 8.14267
: Departure 54′ = 1.73239
: : Mer. Diff. Lat. 97′ = 1.98677
: Diff. Longitude $72\frac{3}{4}'$ = 1.86183

Longitude left 89°. 6′ E.
Diff. Longitude 73′ = 1. 13 E.

Preſent Longitude 90. 19 E.



By Inſpection.

WITH the Difference of Latitude and Departure find the Courſe and Diſtance; and under the Courſe againſt Mer. Diff. Latitude in the Column of Latitude, ſtands the difference of Longitude in the Column of Departure.

2. A SHIP from Latitude 41°. 18′ N. Longitude 21°. 18′ E. after ſailing a certain time, finds ſhe has made 143 Miles of Northing, and 156 of Weſting, What Courſe and Diſtance did ſhe make good, and what is the preſent Latitude and Longitude of the Ship?

Anſ. Courſe N W ¼ W. Diſtance 211.7′.
Latitude 43°. 41′ N. Longitude 17°. 48′ E.

To find a SHIP's PLACE *on the* MERCATOR's CHART; *having given the* DEPARTED PLACE, *and* COURSE *and* DISTANCE *run.*

RULE.

DRAW a Rhumb from the departed Place in poſition of the given Courſe.—Take the Diſtance reduced into Degrees and Minutes from the graduated parallel, and apply it on the ſaid Rhumb from the departed Place; and take the neareſt Diſtance between that Point and a parallel drawn through the place ſailed from; this extent applied to the graduated parallel, gives the Difference of Latitude made; hence the Latitude the Ship is in may eaſily be found; and, by drawing the parallel of the Ship's preſent Latitude through the aforeſaid Rhumb, the point of Interſection is the Ship's preſent Place.

Two PLACES *differing in* LATITUDE *and* LONGITUDE *given; required their* DISTANCE.

RULE.

DRAW a right Line between the two given Places, alſo a parallel of Latitude through the Place whoſe Diſtance is required.—Then find the Difference of Latitude between the two Places, which take in your Compaſſes from the Equator, and ſet one foot on the line of Diſtance, moving it up or down, till the other foot ſweep the parallel paſſing through the given Place, and there ſtay the Compaſſes. Then the Diſtance where the Compaſſes reſted, to the Place whoſe Diſtance you want meaſured on the Equator or graduated parallel, gives the Diſtance required.

Of TIDES.

THE Flux and Reflux of the Sea, producing what we call Tides, are ſuch motions of the Water, as are found regularly to riſe and fall twice in about 24H. 48M.

THE Moon is the principal cauſe of raiſing the Tides: and when ſhe comes to the Meridian of any Place, it then wants about two Hours of being High-water there: but when ſhe appears in the Horizon of ſuch Place, *i. e.* at riſing or ſetting, it is then near Ebb or Low-water.

AT the Times of New and Full Moon, the Tides are greater than ordinary; and theſe are called Spring Tides; but when the Moon is in her Quadratures, or firſt and laſt Quarters; they are leſs then ordinary; and theſe are called Neap Tides.

THE Spring Tides are greateſt about the times of the Equinoxes, or rather at the beginning of April, and October, than at other times of the Year; and the Neap Tides are then the leaſt.

WHEN the Moon is in her Perigee, or neareſt approach to the Earth, the Tides encreaſe more than is uſual at other times; for according to the Laws of Gravitation, the Moon muſt attract moſt when ſhe is neareſt to the Earth.

To know the time when it will be High-water at any Place, depends upon knowing the time when the Moon comes to the Meridian; which is eaſily found by knowing her Age; and that by knowing the Epact for the propoſed Year.

NOTE.

A. M. ſignifies the Morning.
P. M. the Afternoon.

PROBLEM I.

OF THE EPACT.

The Moon's Age on the laſt Day of any Year, is the Epact for the following Year; but when the Solar and Lunar Years begin together, the Epact is nothing.

Now, as the Solar Year exceeds the Lunar by 11 Days, which is the yearly Variation of the Epact; it muſt be obſerved, that at the end of the Lunar Cycle which conſiſts of 19 Years, the Epacts continue to run over again as is evident from the following Table, but at the beginning of a new Century, the retreat of the Moon's Age will be different; and conſequently the order of the Epacts will alter.

A TABLE
SHEWING THE EPACT
UNTIL THE YEAR 2000.

YEARS ABOVE CENTURIES.						CENTURIES.		
						1700	1800	1900
						EPACTS.		
0	19	38	57	76	95	9	4	29
1	20	39	58	77	96	20	15	10
2	21	40	59	78	97	1	26	21
3	22	41	60	79	98	12	7	2
4	23	42	61	80	99	23	18	13
5	24	43	62	81		4	0	24
6	25	44	63	82		15	11	5
7	26	45	64	83		26	22	16
8	27	46	65	84		7	3	27
9	28	47	66	85		18	14	8
10	29	48	67	86		0	25	19
11	30	49	68	87		11	6	0
12	31	50	69	88		22	17	11
13	32	51	70	89		3	28	22
14	33	52	71	90		14	9	3
15	34	53	72	91		25	20	14
16	35	54	73	92		6	1	25
17	36	55	74	93		17	12	6
18	37	56	75	94		28	23	17

USE OF THE TABLE.

LOOK for the Centuries at top, and the odd Years on the left hand, then in the meeting you have the Epacts.

PROBLEM II.

To find the AGE of the MOON.

The Age of the Moon is the number of Days that have paſſed ſince the laſt change, which Age can never exceed 30 Days.

RULE.

To the Epact add the number of the Month, and Day of the Month; the Sum if under 30 is the Moon's Age; but if it exceeds 30, divide by 30, the remainder is her Age.

NUMBERS of the MONTHS.

	Ja.	Feb.	Ma.	Ap.	May	Ju.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Com. Years	0	1	0	2	2	4	4	6	7	8	9	10.
Leap Years	0	2	1	3	3	4	5	6	8	8	10	10.

NOTE.

Leap Year is found by dividing the propoſed Year by 4; and if nothing remains 'tis Leap Year. The Years 1800, 1900, 2100, &c. are common Years according to the New Style or Gregorian Account.

EXAMPLES.

Required the Moon's Age 18th of May, 1794?

Epact for the given Year	28
Number of the Month	2
Day of the Month	18
	48
	30
Moon's Age	18 Days.

What

2. WHAT is the Moon's Age July 10th, 1797?

Anſ. Moon's Age 15 Days.

3. REQUIRED the Moon's Age September 14th, 1804.

Anſ. 10 Days old.

PROBLEM III.

To find the MOON's SOUTHING on any Day.

THE Moon's Southing is the time ſhe comes to the Meridian of any Place, which is every Day later by $\frac{4}{5}$ of an Hour or $48'$; and as ſhe comes to the Meridian at the ſame time with the Sun on the Day of Change, and to the oppoſite Meridian on the Day of Full Moon; her Southing on any other intermediate Day may eaſily be found.

RULE.

MULTIPLY the Moon's Age on the propoſed Day by 4, and divide by 5, the Quotient is the time of Southing in Hours, and the remainder (if any) ſo many 12 Minutes of an Hour.

NOTE.

IF the Hours and Minutes are leſs than 12, the Moon Souths in the Afternoon; but if more than 12, ſubtract 12, and the remainder is the time of Southing next Morning.

EXAMPLES.

AT what time will the Moon be on the Meridian the 19th January, 1799?

Moon's Age by the laſt Problem 12 Days
4
5)48

Moon South's at 9. 36 P. M.
H. M.

2. REQUIRED the time of the Moon's Southing, October 27th 1796?

MOON'S Age 25 Days; now becauſe it is above 15, call her Age 24; and, by proceeding according to Rule, you will have 7 H. 12 M. for the time of Southing on the Morning of the 27th, becauſe uſing 25 gives the time of Southing on the 28th.

PROBLEM IV.

To find the Time of High Water at any Place.

BY the Rotation of the Earth about its Axis, the Moon appears to move quite round from Eaſt to Weſt in 24 Hours, and conſequently muſt paſs over all the points of the Compaſs in that time. And in moving from the N. to the S. ſhe muſt take 12 Hours; and from the N. to the N by E. 45 Minutes; alſo from the N. to the N N E. 1 Hour 30 Minutes, &c.

Table of the Bearings of the Moon at the Time of High Water, on the Days of Full and Change at the Places adjacent.

POINTS	H. M.	POINTS	PLACES NAMES.
N.	12. 0	S.	Iſle of Alderney, Calais and Carliſle, Gibralter, along the Coaſt of Jutland, Oſtend, Southampton.
N. by E.	—. 45	S by W.	Aberdeen, Nore, Beachy in the offing, Weſt Capel.
N. N. E.	1. 30	S. S. W.	Chatham, in the Downs, Queenbro', Ramkins.
N. E. by N.	2. 15	S. W. by S	Liſbon, Coaſt of Morocco, Rouen, Woolwich, C. St. Vincent, before the Weilings, at the Staples.
N. E.	3. 0	S. W.	Amſterdam, Bourdeaux, North Cape, Hook of Holland, Weſt Coaſt of Ireland, London, Newcaſtle, C. Ortegal, New York, Sunderland.
N. E. by E	3. 45	S. W. by W	Bridlington & Bayonne, Hartlepool, Coaſt of Portugal, Rochelle, within Uſhant.
E. N. E.	4. 30	W. S. W.	Baltimore in Ireland, Penzance, River Shannon.
E. by N.	5. 15	W. by S.	At the Sound of Canna, Cork Harbour, Humber.
E.	6. 0	W.	Edyſtone, Plymouth, St. John's Newfoundland.
E. by S.	6. 45	W. by N.	Bridgewater, Lyme, Stanway and Sligo.
E. S. E.	7. 30	W. N. W.	Archangel, Briſtol, Cape Barfleur, off the Start Cherbourg, Quebec.
S. E. by E.	8. 15	N. W. by W	Caſkets, Portland, Texel Road, St. Magnes Sound.
S. E.	9. 0	N. W.	Iſle of Man, Pool, Bella Caſtle, Mull of Cantire, before the Eaſtern and Weſtern Emes, Fairland, Honfleur, on Haſbro' Sand.
S. E by S.	9. 45	N W. by N.	Dublin, on the Flats and at the Forelands, Yarmouth Roads, C. Blanco.
S. S. E.	10. 30	N. N. W.	Beachy Head, Needles, all the Coaſt of Normandy and Picardy, Senegal.
S. by E.	11. 15	N. by W.	Cowes, Dieppe, Mull of Galway, St. Helens, Havre-de-Grace, Liverpool, Portſmouth, Naze, North and South Rocks.

It has been obſerved, that the Ocean in moſt Places flows and ebbs twice in 24h. 48m. therefore it is evident, that 12h. 24m. muſt be the Diſtance of one Tide from another. And becauſe the Moon's Southing is later every Day by 48 Minutes, every Tide muſt be later by 24 Minutes than the preceding one; which is the caſe throughout the whole of the Moon's motion.

RULE.

To the time of the Moon's Southing on the given Day, add the Time of High Water on Full and Change at the given Place; the Sum is the Time of High Water there, counting from Noon or Midnight.

EXAMPLES.

Required the Time of High Water at Portſmouth, June 17th, 1793?

Epact for the Year	17		
Number of the Month	4		
Day of the Month	17		
	38		
	30		
Moon's Age	8		
	4		
	5)32		
Moon Souths at	6	24	P. M.
Point making full Sea	11	15	
	17	39	
	12	24	
Time of High Water June 17th	5	15	P. M.
		24	
Do. Do.	4	51	A. M.

2. REQUIRED the Time of High Water at London, May 30th, 1791?

Anſ. High Water May 30th, 11h. 48′ A. M. and May 31ſt. 12h. 12′ A. M.

3. REQUIRED the Time of High Water of Plymouth, Auguſt 24th, 1796.

Anſ. High Water at 9h. 12′ A. M. and at 9h. 36′ P. M. on the given Day.

TO ESTIMATE
DISTANCES
BY THE
MOTION OF SOUND.

SOUND is cauſed by the undulatory Motion of the Air, when the Particles thereof are put in Motion by a ſtroke on ſome Body, the firing of a Gun, &c.

THE Motion of Sound is always the ſame, whether Day or Night, Winter or Summer, by Sea or by Land; in dry or in rainy Weather, but not always equally ſtrong, by reaſon of the Rarefaction or Denſity of the Air.

IT has been found from repeated Experiments, that Sound flies in all ſtates of the Atmoſphere through equal ſpaces in equal times, at the rate of 1142 Feet per Second.

Note. 1 Land Mile = 5280 } Feet.
1 Sea Mile = 6120 }

EXAMPLES,

EXAMPLES.

Being at Sea, I ſaw the flaſh of a Gun, and 35 Seconds afterwards I heard the Report, at what Diſtance was the Gun from me?

```
      1142
        35
      ----
      5710
     3426
      ----
6120) 39970 (6 Miles.
      36720
      ----
      3250 = ½ a Mile.
```

Anſ. 6½ Miles.

2. Suppose I count 40 Seconds by my Watch between ſeeing a flaſh of lightning, and hearing the thunder. What Diſtance was the Cloud from me?

Anſ. 8 Miles 3440 Feet.

To CORRECT DISTANCES.

The common Method uſed for meaſuring a Ship's run, is by the Log and Half Minute Glaſs. To the Log, which is a ſectoral piece of wood, is faſtened a line, called the Log-line of about 150 Fathoms in length, divided into certain ſpaces called Knots; each of which ought to bear the ſame proportion to a Sea Mile, as Half a Minute does to an Hour. Now the $\frac{1}{120}$ part of a Sea Mile is 51 Feet, which ſhould be the length of each Knot, but as it is ſafer to have the reckoning rather before the Ship than after her, 50 feet may be taken for the proper length of each Knot: and a Knot may be again ſubdivided into 10 equal parts called Fathoms.

It is uſual to heave the Log every Hour, the method of which is very eaſy, and the Knots and Fathoms which run off in Half a Minute ſhew the Diſtance the Ship has run the preceding Hour; on the ſuppoſition, that the Ship continues to ſail with the ſame Velocity, and alſo in the ſame Direction that Hour, ſhe did during the Half Minute.

As the Diſtance given by the Log may happen to be wrong on three Accounts, viz: By there being an error either in the Glaſs, or Log, or in both; it is neceſſary to ſhew how it may be corrected.

CASE I.

When the Glaſs is Faulty.

RULE.

As the Seconds run by the Glaſs, is to the Diſtance run by the Log, ſo is 30 Seconds, is to the true Diſtance.

EXAMPLE.

If a Ship ſails at the Rate of 5 Knots an Hour by a Glaſs that runs but 24 Seconds, what is the true rate of ſailing?

As $24'' : 5' :: 30'' : 6\frac{1}{4}$ Miles, the true rate of ſailing.

CASE

CASE II.

When the Log-line is Faulty.

RULE.

As 50 feet is to the Diſtance run by the Log; ſo is the meaſured Diſtance between Knot and Knot, to the true Diſtance.

EXAMPLE.

A SHIP ſails $5\frac{1}{2}$ Knots an Hour by a Log-line which has but 42 feet to a Knot. What is the true rate of ſailing?

As 50 : 5.5 :: 42 : 4 62 Miles, the true Diſtance ſailed.

CASE III.

When the Log-line and Glaſs are Faulty.

RULE.

MULTIPLY three times the meaſured length of a Knot by the Diſtance run per Log; the product divided by 5 times the meaſured time of the Glaſs, gives the true Diſtance run.

EXAMPLE.

SUPPOSE a Ship runs 5 Knots an Hour, by a Log-line of 42 feet to a Knot and a Glaſs of 26 Seconds. Required the true rate of ſailing?

$$\frac{42\times 3\times 5}{26\times 5} = \frac{630}{130} = 4.84 \text{ Miles, the true Diſt.}$$

How to proportion, or make Log-lines to any Glaſs.

RULE.

MULTIPLY the Seconds in the Glaſs by 5, and divide the product by 3, gives the Length in feet to one knot.

O N

ON

NAUTICAL ASTRONOMY.

DEFINITIONS.

BY Aſtronomy in general we are to underſtand, the Motions and Diſtances of the heavenly Bodies, according to their ſeveral appearances.

NAUTICAL Aſtronomy, is that which relates principally to the finding the Latitude and Longitude of a Ship at Sea, by Celeſtial Obſervations.

THE Horizon, which is one of the moſt uſeful Circles in Aſtronomy, is that great Circle which determines the riſing and ſetting of the Sun, Moon, and Stars, as HO.

THE Apparent Horizon, which is parallel to the Rational one, at the diſtance of the Semidiameter of the Earth, is that Circle which terminates the view of the Spectator.

THE Ecliptic, is a great Circle inclined to the Equator in an Angle of 23° 28′, called the Obliquity of the Ecliptic, as ♋♑.

LATITUDE of the Moon, or of a Star, is an arc of a Circle of Longitude, intercepted between her Centre and the Ecliptic, as L ☽.

LONGITUDE of the Sun, Moon, or Star, is an arc of the Ecliptic intercepted between the firſt point of Aries, and a Circle of Longitude paſſing through the Centre of the Object, as ♈ ☼.

THE Latitude and Longitude of the Moon are uſed in computing her Diſtances from the Sun and Stars, in the

Nautical Almanac; though the Moon's Diſtance from the Sun at any time may be found by their Longitudes, independent of the Diſtances given in the Ephemeris.

Declination, is an arc of a Meridian intercepted between the centre of the Sun, &c. and the Equinoctial; and is either North or South, according as the Object is on the North or South ſide of the Equinoctial, as B ✱, or C ☼.

Amplitude of a Celeſtial Object, is an arc of the Horizon contained between the Centre of the Object at its riſing or ſetting, and the Eaſt or Weſt Point, as ♈ ☼.

Azimuth of any Celeſtial Object, is an arc of the Horizon intercepted between the Meridian of any Place, and a vertical Circle paſſing through the Centre of the Object when above the Horizon; as HA or OA. Or, 'tis the ſame with the Angle at the Zenith formed by the ſame Circles, as HZA and OZA.

Zenith, is that point of the Heavens directly over our Heads, as Z; and the Nadir, is the point directly under our feet, as N.

Right Aſcenſion of the Sun, Moon, or Star, is an arc of the Equator contained betwen the firſt point of Aries and a Meridian paſſing through the Centre of the Object, as ♈ B.

Altitude, is the height of any Celeſtial Object above the Horizon, meaſured on an Azimuth Circle, as A ☼ and A ☽.

Observed Altitude of the Sun or Moon, is the Altitude of their upper or lower Limb.

APPARENT Altitude of the Sun's Centre, is the obſerved Altitude corrected by Dip and Semidiameter.

APPARENT Altitude of the Moon, is the obſerved Altitude corrected by Semidiameter, Augmentation, and Dip.

APPARENT Altitude of a Star, is the obſerved Altitude corrected by Dip only.

THE true Altitude of the Sun or Moon's Centre, is the Apparent Altitude corrected by Parallax and Refraction, and of a Star, by Refraction only.

MERIDIAN Altitude, is when the Object is on the Meridian of any Place; at which Time it has its greateſt Altitude, as H☼......O✱ the leaſt, is called the Mer. Alt. below the Pole.

ZENITH Diſtance or Co-Altitude, is what the true Altitude of any Object wants of 90°, as ☼Z.

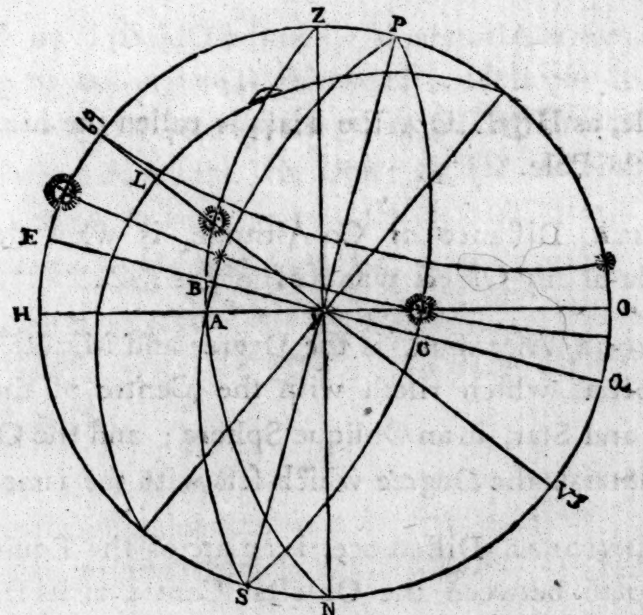
OBLIQUE Aſcenſion, is the Degree and Minute of the Equinoctial which riſeth with the Centre of the Sun, Moon, and Star, in an Oblique Sphere; and the Oblique Deſcenſion, is the Degree which ſets with the ſame.

ASCENSIONAL Difference, is an arc of the Equinoctial intercepted between the Objects' Centre at its riſing or ſetting and the Equinoctial Point; or it is that ſpace of time the Object riſes before, or ſets after 6 o'Clock, as ♈C.

SUN or Moon's Place, is that Sign, Degree, Minute, &c. of the Ecliptic the Sun or Moon is in at any time, as ☼.

REFRACTION is the difference between the True and Apparent Altitudes of Celeſtial Objects; and muſt always be ſubtracted from the Apparent Altitude; becauſe every Object is thereby raiſed higher than it really is; occaſioned by the denſity of the Earth's Atmoſphere.

PARALLAX of the Sun or Moon, is the difference between their True and Apparent Places, as ſeen from the Center and Surface of the Earth, and is always to be added to the Apparent Altitude, on account of its cauſing all Objects to appear lower than they really are.



HORIZONTAL Parallax, is the Parallax of the Sun or Moon when in the Horizon; which is then greateſt: or it is the difference between their True and Apparent Places at their riſing or ſetting.

PARALLAX in Altitude, is a quantity ariſing from the Horizontal Parallax, which decreaſes as the Object increaſes in Altitude, until it arrives at the Zenith, where it is nothing.

APPARENT Diſtance between the Sun and Moon, or Moon and Star, is the obſerved Diſtance of their Limbs corrected by their true Semidiameters.

LIMB of the Sun or Moon, is the upper or lower Edge thereof, or any Point of their Circumference.

SEMIDIAMETER of the Sun or Moon, is the Diſtance between their Centre and Limb, as obſerved or meaſured.

AUGMENTATION of the Moon's Semidiameter, is a quantity to be added thereto, according to her Altitude at the time of Obſervation: becauſe the higher ſhe riſes in Altitude, the nearer ſhe approaches the Obſerver.

DIP of the Horizon, is the Depreſſion of the Horizon of the Sea, below the true, and is more or leſs, according to the Elevation of the Obſerver's Eye above the Surface of the Water.

TO CONVERT TIME INTO MOTION.

RULE.

REDUCE the Hours and Minutes, into Minutes, and divide by 4, the Quotient of the Minutes will be Degrees, that of the Seconds, Minutes, and that of the Thirds, Seconds, &c.

NOTE.

$$\left.\begin{array}{r}15^{\circ}\\1^{\circ}\\15'\end{array}\right\}\text{ in Motion make }\left\{\begin{array}{l}\text{1 Hour in Time.}\\\text{4 Minutes.}\\\text{1 Minute.}\end{array}\right.$$

BRING 3h. 18′. 48″. into Motion.

$$\begin{array}{r|l}4 & 3\text{h}.\ 18'.\ 48''.\\\hline & 49^{\circ}.\ 42'.\end{array}$$

CONVERT 17h. 48′. 43″. into Degrees, Minutes, &c.

Anſ. 267°. 10′. 45″.

TO BRING MOTION INTO TIME.

RULE.

MULTIPLY the Degrees, Minutes, &c. by 4; the Seconds will be Thirds; the Minutes, Seconds; and the Degrees, Minutes of Time.

CONVERT 17°. 17′. 17″. into Time.

$$\begin{array}{r}4\\\hline 1\text{h}.\ 9'.\ 9''.\ 8'''.\end{array}$$

IN 214°. 49′. 44″. how many Hours, Minutes, &c.

Anſ. 14h. 19′. 18″. 56‴.

TO FIND
GREENWICH TIME IN ANY LONGITUDE.

ALL Places that lie to the Eaſtward of the Meridian of Greenwich, have their Noon ſooner; and thoſe that lie to the Weſt, later than at Greenwich, according to their Longitudes: therefore to find the Greenwich Time at any of theſe Places we have this

RULE.

WHEN the Longitude is Eaſt, ſubtract the Longitude of the Ship in Time, from the Ship's Time; but when it is Weſt, add it to the Ship's Time, gives the Greenwich Time; and to know whether it is A. M. or P. M. obſerve the Remarks above.

EXAMPLES.

AT Sea, July 14th, 1790, at 4h. 18′. 48″. A. M. the Longitude was 98°. 17′. 38″. E. Required the Greenwich Time?

Ship's Time	4h.	18′.	48″.	A. M.
Ship's Long. 98°. 17′. 38″.=	6.	33.	11.	E.
Greenwich Time July 13th,	9.	45′.	37″.	P. M.

AT Sea, January 24th, 1790, at 11h. 14′. 30″. P. M. in Longitude 48°. 14′. W. What was the Time at Greenwich?

Ship's Time 11h. 14′. 30″. P. M.
Ship's Long. 48°. 14′. = 3. 12. 56. W.

Time at Greenwich Jan. 25th 2. 27′. 26″. A. M.

At Sea by Obſervation, March 4th, 1791, in Longitude 44°. 44′. 48″. W. when the Time of the Ship was 7h. 44′. 18″. A. M. The Time at Greenwich is required?

Anſ. 10h. 43′. 17″. A. M.

At Sea in Longitude 173°. 10′. 49″. E. when it was Noon at the Ship. What o'Clock was it at Greenwich?

Anſ. 12h. 27′. 17″. A. M.

TO FIND THE
SUN's DECLINATION.

THE Aſtronomical, and Sea Day, commence at Noon of the Civil Day; to which Time all the particulars in the Nautical Ephemeris are calculated; except thoſe of the Moon, which are calculated to Noon and Midnight.

The Sun's Declination is calculated to the neareſt Second for that Time to the Meridian of Greenwich, and may be reduced to any other Meridian, by firſt finding the Greenwich Time there.

The Sun's Declination is uſed in finding the Latitude by Obſervation either by Sea or Land, the Sun's Amplitude, Azimuth, Variation of the Compaſs, and Altitude, if neglected to be obſerved at the Time of taking the Moon's

Diſtance from the Sun for finding the Longitude; in which Caſes, the Degrees and neareſt Minutes may be uſed without any material error.

To find the Declination at any Hour.

RULE.

If the Declination is wanted A. M. take the Difference between the Sun's Declination at Noon on the given Day, and Noon of the Day preceding; but if P. M. on the Noon of the Day following:—Then ſay,

As 24 Hours : that Difference :: the Hours and Minutes elapſed ſince the laſt Noon : a proportional part, to be added to the Declination laſt Noon if increaſing; or ſubtracted if decreaſing, for the Declination at the propoſed Time.

NOTE.

By the ſame Rule, the Sun's Longitude and right Aſcenſion may be found to any intermediate Time, and in any Longitude.

EXAMPLES.

Required the Sun's Declination at Greenwich, June 1ſt, 1791, at 6h. 18′. 44″ P. M.

June 1ſt. Decl.		22°. 6′ N.
2nd.		22. 13 N.
	Diff.	7 increaſing.

As 24h : 7′ :: 6h 19′ : 2′ nearly.
Decl. June 1ſt. at Noon 22°. 6′. N.
2

Decl. at the propoſed Time 22. 8 N.

Required the Sun's Declination at Greenwich, July 20th, 1791, at 7h. 40′. 30″ A. M.

Anſ. Declination 20°. 42′ N.

At Sea, Auguſt 27th, 1791, in Longitude by Account 27°. 40′ W. about 3h. 28′ P. M. What was the Sun's Declination?

Anſ. 9°. 57′ N.

TO FIND THE TIME WHEN THE MOON PASSES THE MERIDIAN OF ANY PLACE.

THE time the Moon paſſes the Meridian of Greenwich every Day is ſhewn in the Ephemeris; and it is evident, ſhe paſſes the Meridian of any Place later every Day, than ſhe did the Day before by a number of Minutes. It is alſo obvious, that ſhe muſt paſs the Meridians of Places Eaſtward ſooner, and thoſe Weſtward later, than ſhe paſſes the Meridian of Greenwich. And, as it is uſeful at Sea, to know the Time of the Moon's Paſſage over the Meridian of ſuch Places, in order to determine the Latitude by her Meridian Altitude, it is neceſſary to ſhew how it may be found.

RULE.

If the Longitude of the Ship or Place be Eaſt take the Difference between the time of the Moon's Paſſage over the Meridian of Greenwich on the propoſed Day, and Day preceding ; but if the Longitude be Weſt, take the difference between the time of her Paſſage on the propoſed Day, and Day following, then ſay,

As 24 Hours : that Difference : : the Longitude of the given place, in Time : a proportional part to be ſubtracted from the time of the Moon's paſſage over the Meridian of Greenwich, on the given Day, if the Longitude be Eaſt; or added to it, if the Longitude was Weſt; for the Time when ſhe paſſes Meridian of the given Place.

EXAMPLES.

At Sea, September 13th, 1791, in Longitude 100° E. Required the time of the Moon's paſſing the Meridian?

☽ 's Paſſage Sep. 13th 13h. 9′
12th 12. 22
Diff. 47

As 24h. : 47′ :: 6h. 40′ : 13′
Moon's Paſſage Sep. 13th 13h. 9′
Sub. 13
Moon on the Meridian at 12. 56

At Sea, July 24th, 1791, in Longitude 78° W. What was the time of the Moon's Paſſing the Meridian?

Anſ. At 19h. 38′.

TO FIND THE

MOON's HORIZONTAL PARALLAX

AND

SEMI-DIAMETER AT ANY TIME.

THE Moon's Horizontal Parallax and Semi-diameter are computed twice a Day; viz. to Noon and Midnight in the Nautical Ephemeris, and may be found at any other time, or in any Longitude with great exactneſs by Proportion.

THE Moon's Semi-diameter and Horizontal Parallax are applied in correcting almoſt all Obſervations of the Moon, eſpecially in finding the Latitude, by the Meridian Altitude of her upper or lower Limb.

RULE.

IF the Horizontal Parallax and Semi-diameter are wanted A. M. take the difference between the Horizontal Parallax and Semi-diameter for the preceding Midnight, and the Noon following; but if the time is P. M. take the difference between the Horizontal Parallax and Semi-diameter for the Noon of the given Day, and following Midnight.

MULTIPLY each difference by the intermediate Hours, and divide by 12, gives a proportional part to be added to, or ſubtracted from the Horizontal Parallax, and Semi-diameter, at Midnight, or Noon, according as they are increaſing or decreaſing.

After the ſame manner may the Moon's Latitude and Longitude, right Aſcenſion, and Declination, be found at any Time and Place.

EXAMPLES.

Required the Moon's Horizontal Parallax and Semidiameter, May 14th, 1791, at 3h. 50′ A. M.

	S. Dr.	H. Par.
May 13th at Midnight	16′.11″	59′.22″
14th at Noon	16.18	59.49
Diff.	7	27
	4	4
	12)28	12)108
Increaſing	2	9
	16.11	59.22
At 3h. 50′ A. M. Semidr.	16.13	H Par. 59.31

At Greenwich: What was the Moon's Semi-diameter, and Horizontal Parallax, March 3d, 1791, at 8h. 20′ P. M.

Anſ. Semi-diameter 15′. 24″—Hor. Par. 56′. 30″.

At Sea June 11th, 1791, about 8h. 28′ A. M. in Longitude by Account 108° E. What was the Moon's Horizontal Parallax and Semi-diameter?

Anſ. Semi-diameter 16′. 6″—Hor. Parallax 59′. 4″.

At Sea, March 24th, 1791, in Longitude 90° W. when the Moon was on the Meridian; what was her Horizontal Parallax, Semi-diameter, and Declination?

Anſ. H. Par. 59′.36″—Semidr. 16′.14″—Dec. 18°.25′ S.

Moon's Apparent Altitude and Horizontal Parallax given; required the Correction of her Altitude.

RULE.

FROM the Log Sine of the Moon's Horizontal Parallax ſubtract the Secant leſs Radius of her Apparent Altitude, the remainder is the Log Sine of her Parallax in Altitude; from which ſubtract the Refraction, leaves the Correction of her Altitude.

EXAMPLES.

SUPPOSE the Moon's Apparent Altitude be 18°. 48' and her Horizontal Parallax 54'.50'' what is the Correction of her Altitude?

Sine ☽'s Hor. Par.	54'.50''	=	8 20274
Secant App. Alt.	18°.48'	=	0.02381
Sine Par. in Alt.	51'.54''	=	8.17893
Refraction ſub.	2'.46		
Correction	49. 8		

MOON's Apparent Altitude 50°. 35' 47''. Horizontal Parallax 56'. 44''. Required the Correction of her Altitude?

Anſ. Correction 35'. 14''

MOON's Apparent Altitude 5°. 17'. Horizontal Parallax 61'. 48''. What is the Correction of her Altitude?

Anſ. 52'.4''.

DEPRESSION or DIP of the HORIZON of the SEA.				The SUN's Parallax in Altitude.		Augmentation of the MOON's Semi-diameter.	
Height of the Eye in Feet.	DIP. ′ ″	Height of the Eye.	DIP. ′ ″	SUN's Alt. °	Parallax. ″	MOON's Alt. °	Aug. ″
1	0.57	19	4.10				
2	1.21	20	4.16				
3	1.39	21	4.22				
4	1.55	22	4.28				
5	2. 8	23	4.34	0	9	0	0
6	2.20	24	4.40	10	9	5	1
7	2.31	26	4.52	20	8	10	3
8	2.42	28	5. 3	30	8	15	4
9	2.52	30	5.14	40	7	20	6
10	3. 1	35	5.39	50	6	25	7
11	3.10	40	6. 2	55	5	30	8
12	3.18	45	6.24	60	4	35	9
13	3.26	50	6.44	65	4	40	10
14	3.34	60	7.23	70	3	45	11
15	3.42	70	7.59	75	2	50	12
16	3.49	80	8.32	80	2	55	13
17	3.56	90	9. 3	85	1	60	14
18	4. 3	100	9.33	90	0	70	15
						80	16
						&c.	

To Compute the Dip of the Horizon.

RULE.

To ½ the Logarithm of the height of the Eye in Feet, add the conſtant Log. 1·75815 the Sum is the Log. of the Dip in Seconds.

If the Eye of a Perſon be elevated 20 Feet above the Surface of the Sea. Required the Depreſſion of the Horizon.

Log. 20 = 1.30103

Its ½ 65051
Conſtant Log. 1.75815

256″ = 2 40866, or 4′.16″ *Anſ.*

The Refraction of the Heavenly Bodies in Altitude.

App. Alt.	Ref.	App. Alt.	Ref.	App. Alt.	Ref.	App. Alt.	Ref.
° ′	′ ″	° ′	′ ″	° ′	′ ″	°	″
0. 0	33. 0	4. 0	11.51	12.20	4.16	45	57
0. 5	32.10	4.10	11.29	12.40	4. 9	46	55
0.10	31.22	4.20	11. 8	13. 0	4. 3	47	53
0.15	30.35	4.30	10.48	13.20	3.57	48	51
0.20	29.50	4.40	10.29	13.40	3.51	49	49
0.25	29. 6	4.50	10.11	14. 0	3.45	50	48
0.30	28.22	5. 0	9.54	14.20	3.40	51	46
0.35	27.41	5.10	9.38	14.40	3.35	52	44
0.40	27. 0	5.20	9.23	15. 0	3.30	53	43
0.45	26.20	5.30	9. 8	15.30	3.24	54	41
0.50	25.42	5.40	8.54	16. 0	3.17	55	40
0.55	25. 5	5.50	8.41	16.30	3.10	56	38
1. 0	24.29	6. 0	8.28	17. 0	3. 4	57	37
1. 5	23.54	6.10	8.15	17.80	2.59	58	35
1.10	23.20	6.20	8. 3	18. 0	2.54	59	34
1.15	22.47	6.30	7.51	18.30	2.49	60	33
1.20	22.15	6.40	7.40	19. 0	2.44	61	32
1.25	21.44	6.50	7.30	19.30	2.39	62	30
1.30	21.15	7. 0	7.20	20. 0	2.35	63	29
1.35	20.46	7.10	7.11	20.30	2.31	64	28
1.40	20.18	7.20	7. 2	21. 0	2.27	65	26
1.45	19.51	7.30	6.53	21.30	2.24	66	25
1.50	19.25	7.40	6.45	22. 0	2.20	67	24
1.55	19. 0	7.50	6.37	23. 0	2.14	68	23
2. 0	18.35	8. 0	6.29	24. 0	2. 7	69	22
2. 5	18.11	8.10	6.22	25. 0	2. 2	70	21
2.10	17.48	8.20	6.15	26. 0	1.56	71	19
2.15	17.26	8.30	6. 8	27. 0	1.51	72	18
2.20	17. 4	8.40	6. 1	28. 0	1.47	73	17
2.25	16.44	8.50	5.55	29. 0	1.42	74	16
2.30	16.24	9. 0	5.48	30.	1.38	75	15
2.35	16. 4	9.10	5.42	31.	1.35	76	14
2.40	15.45	9.20	5.36	32.	1.31	77	13
2.45	15.27	9.30	5.31	33.	1.28	78	12
2.50	15. 9	9.40	5.25	34.	1.24	79	11
2.55	14.52	9.50	5.20	35.	1.21	80	10
3. 0	14.36	10. 0	5.15	36.	1.18	81	9
3. 5	14.20	10.15	5. 7	37.	1.16	82	8
3.10	14. 4	10.30	5. 0	38.	1.13	83	7
3.15	13.49	10.45	4.53	39.	1.10	84	6
3.20	13.34	11. 0	4.47	40.	1. 8	85	5
3.25	13.20	11.15	4.40	41.	1. 5	86	4
3.30	13. 6	11.30	4.44	42.	1. 3	87	3
3.40	12.40	11.45	4.29	43.	1. 1	88	2
3.50	12.15	12. 0	4.23	44.	0.59	89	1

TO FIND THE

LATITUDE BY OBSERVATION.

THE Latitude of a Place can be found when the Sun, Moon, or Star are on the Meridian of that Place, or it may be found by two Obſervations of the Sun, when he is off the Meridian.

To find the Latitude by a Meridian Obſervation.

IN Latitudes within the Polar Circles, or near the Poles, when the Sun's Declination exceeds the Co-Latitude, the Sun then does not ſet; but may be ſeen to tranſit the Meridian twice in 24 Hours, and hence two Altitudes may be taken on the Meridian; the leaſt of which is called the Altitude below the Pole; the ſame may be obſerved of ſuch Stars as do not ſet.

AT Places within the Torrid Zone, when the Sun is Vertical, or in your Zenith, the Latitude is equal to, and of the ſame Name with the Declination.

WHEN the Object has no Declination the Latitude is equal to its Meridianal Zenith Diſtance, and if the Zenith be North of the Sun, the Latitude is North, but if it be South of the Sun, the Latitude is South.

A GENERAL RULE.

When you have found the true Meridian Altitude of the obſerved Object, find its Zenith Diſtance by ſubtracting it from 90°. which is North, if the Zenith was to the North of the Sun, or South if it was the contrary.

If the Object was the Sun or Moon, take its Declination from the Nautical Ephemeris, if a Star from P. 113 of this Book, noting whether it be North or South.

Then if the Zenith Diſtance and Declination are both North, or both South, add them together; but if one be North, and the other South, ſubtract the leſs from the greater, gives the Latitude of the ſame Name with the greater.

PROBLEM I.

To find the Latitude of a Ship from the Meridian Altitude of the Sun's upper and lower Limb.

RULE.

If the lower Limb was obſerved, add the difference between the Sun's Semi-diameter and Dip, but if the upper Limb, ſubtract their ſum, gives the Apparent Altitude, from which ſubtract the difference between the Refraction and Parallax in Altitude, gives the true Meridian Altitude of the Sun's Centre. Then proceed for the Latitude by the general Rule.

EXAMPLES.

At Sea January 14th, 1791, in Longitude 60° E. the Meridian Altitude of the Sun's lower Limb was obſerved to be 14°.40′, the Zenith being North of the Sun, and the height of the Obſerver's Eye 30 feet above the ſurface of the Sea. What was the Latitude?

	′ ″	° ′ ″
Altitude of the ⊙'s lower Limb		14.40.0
Semi-diameter	16.19	
Dip of the Horizon ſub.	5.14	
		add 11.5.
App. Altitude ⊙'s Centre		14.51.5
Refraction	3.32	
Parallax in Alt. ſub.	9	
		ſub. 3.23
True Altitude ⊙'s Centre		14.47.42
		90
True Zenith Diſtance		75.12.18 N.
⊙'s Dec. at Noon in Long. 60° E.		21.17.30 S.
Latitude of the Ship		53.54.48 N.

The preceding Rule and Example are adapted to a fore Obſervation; but when you are obliged to uſe the back Obſervation, and obſerve the lower limb of the Sun, ſubtract the difference between the Semi-diameter and the Dip, but if the upper limb was obſerved, add their ſum, give the apparent Altitude, then proceed as before for the true Altitude of the Sun's centre, and Latitude.

At Sea May 30th, 1791. Suppoſe an Obſerver on the Poop of a Ship in Longitude 85° W. ſhould by a back obſervation with Hadley's Quadrant, find the Meridian

Altitude of the Sun's lower Limb to be 57°.45′ the Zenith being South of the Sun, and the height of the Eye 29 Feet above the Water. Required the Latitude of the Place of Obſervation?

	′ ″	° ′ ″
Obſerved Altitude ☉'s lower Limb		57.45. 0
Semi-diameter	15.49	
Dip of the Horizon ſub.	8	
		ſub. 10.41
Apparent Altitude		57.34.19
Refraction	36″	
Parallax in Alt. ſub.	5	
		ſub. 31
True Altitude ☉'s Centre		57.33.48
		90
True Zenith Diſtance		32.26.12 S.
☉'s Declin. at Noon in Long. 85° W.		21,50.35 N.
Latitude of the Ship		10.35.37 S.

PROBLEM II.

To find the Latitude of a Ship at Sea, from the obſerved Meridian Altitude of a fixed Star.

RULE.

From the obſerved Altitude ſubtract the Dip, gives the Apparent Altitude; from which take the Refraction; and you will have the true Altitude of the Star; then proceed as before.

NOTE.

In taking the Altitude of the Moon or a Star by Night, the Obſerver muſt always get as near the Water as poſſible, for the nearer the Eye is to the ſurface of the Water in all Obſervations, the nearer will the Apparent Horizon be to the Eye.

The fixed Stars have no Apparent Semi-diameter, and are free from Parallax.

The brighteſt of the Planets which paſſes the Meridian at Night is Jupiter; which affords the Navigator an opportunity of determining his Latitude, if the Sun was hid the preceding Day.

May 10th, 1791, the Meridian Altitude of Regulus was obſerved 48°.44′ the Zenith being North of the Star; and the height of the Obſerver's Eye above the ſurface of the Sea 20 feet. What was the Latitude?

	° ′ ″
Meridian Altitude of Regulus	48.44. 0
Dip of the Horizon ſub.	4.16
Apparent Altitude	48.39.44
Refraction ſub.	50
True Altitude Regulus	48.38.54
	90
Zenith Diſtance	41.21. 6 N.
Declination of Regulus	12.58.49 N.
Latitude of the Ship	54.19.55 N.

SCHOLIUM.

When the Sun in any Place where he does not ſet, or a Circum-polar Star, is obſerved on the Meridian below the Pole; then if to ſuch Altitude corrected as above, there be added the Complement of the Sun or Star's Declination, the ſum will be the Latitude of the Place of the ſame name with the Declination.

PROBLEM III.

To find the Latitude of a Ship, from the obſerved Meridian Altitude of the Moon's upper or lower Limb.

RULE.

Find the time at Greenwich when the Moon was on the Meridian of the given Place; to which time find the Moon's Horizontal Parallax, Semi-diameter, and Declination, noting whether it be North or South.

Correct the Moon's obſerved Altitude, as you did the Sun's, only inſtead of the Sun's Semi-diameter, uſe the Moon's augmented Semi-diameter, and you will have her Apparent Altitude, to which add the Correction, gives the true Altitude of her Centre: then proceed as before.

At Sea, September 10th, 1791, in Longitude 127° W. the Meridian Altitude of the Moon's upper Limb was obſerved to be 49°.30′.48″ the Zenith being North of the Moon; and the height of the Obſerver's Eye 18 feet above the ſurface of the Sea. Required the Latitude?

☽'s Paſſage

	h ,	
☽'s Paſſage Sep. 10th,	10. 45	at Greenwich.
11th,	11. 34	
Diff.	49	

As 24h. : 49 :: 8h. 28′ (=127°) : 17′

	h ,
☽'s Paſſage Sep. 10th.	10. 45
	17
☽ on the Meridian at the given Place	11. 2 P. M.
Ship's Longitude	8. 28 W.

Time at Greenwich, Sep. 11th, 7. 30 A. M. of the Moon's paſſing the Meridian of the given Place; at which time her Horizontal Parallax was 57′.35″ her Semidiameter 15′.42″ and Declination 6°.51′.53″S.

		° ′ ″
Altitude ☽'s upper Limb		49.30.48
	′ ″	
☽'s Semi-diameter	15.42	
Augmentation	12	
Aug. Semi-diameter	15.54	
Dip add	4. 3	
		19.57
Apparent Altitude		49.10.51
	′ ″	
S. ☽'s Horizontal Par.	57.35 = 8.22398	
Sec. Apparent Alt.	49°.10.51 = 0.18463	
Sine Par. in Alt.	37.38 = 8.03935	
Refraction ſub.	49	
Correction	36.49	36.49
True Altitude of the ☽'s Centre		49.47.40
		90
True Zenith Diſtance		40.12.20 N.
Moon's Declination		6.51.53 S.
Latitude of the Ship		33.20.27 N.

TO

TO FIND THE
LATITUDE AT SEA,
BY
DOUBLE ALTITUDES.

PROBLEM.

Having the Latitude by Account, two obſerved Altitudes of the Sun; and the intermediate time between the Obſervations, meaſured by a common Watch, and Sun's Declination; to find the true Latitude.

RULE.

1. TO the Secant of the Latitude by account, add the Secant of the Sun's Declination; their ſum, rejecting 20 from the Index, is the Log Ratio.

2. To the Log Coſine of half the ſum, and Log Sine of half the difference of the two Altitudes, add the Co-Secant of the Degrees and Minutes in half the elapſed Time, and Log Ratio; ther ſum rejecting 20 from the Index, is the Log Sine of an Arc.

3. WITH the difference between this Arc, and half the elapſed Angle, find its natural Coſine, and take the Co-ar. thereof to 1, and find its Logarithm.

4. From this Log ſubtract the Log Ratio ; and find a natural Number correſponding to the remainder ; to which add the natural Sine of the greateſt Altitude ; gives the natural Sine of the Sun's Meridian Altitude. Hence the Latitude of the Ship may be found by the General Rule for Meridian Obſervations.

SCHOLIUM.

If the Latitude found by the preceeding Rule, differ greatly from the Latitude by Account, the operation muſt be repeated, uſing the Latitude laſt found, inſtead of that by Account.

Obſervations on this Rule.

1. The operation is the ſame, whether the Sun hath North or South Declination ; and alſo whether the Ship be in North or South Latitude.

2. When the Sun hath no Declination, the Secant leſs Radius of the Latitude will be the Log Ratio.

3. It holds good any time between 9 o'Clock A. M. and 3 P. M. and the nearer the greater Altitude is to Noon the better.

4. If both the Obſervations are made A. M. the interval muſt not be much leſs than half the Diſtance of the firſt Obſervation from Noon.

5. If both Obſervations are P. M. the interval between them muſt not be leſs than the Diſtance of the firſt Obſervation from Noon.

6. Observations taken one A. M. and the other P.M. the interval muſt not exceed 4½ Hours.

EXAMPLES.

EXAMPLES.

At Sea May 28th, 1791, in Latitude 50°.44′N. by Account, at 9h. 30′ by my Watch, the Altitude of the Sun's lower Limb was obſerved to be 48°. 32′. 24″, and at 10h. 15′. it was 54°. 8′. 27″; and the height of the Eye above the Surface of the Sea 30 feet. Required the true Latitude of the Ship?

	1ſt. Obſ.	2d.
Alt. ⊙'s L. L.	48°. 32′. 24″.—	54°. 8′ 27″
Dip. ſubtract	5. 14	5. 14
⊙'s Semid. add	15. 49	15. 49
Refraction ſub.	50	41
True Alt. ⊙'s Centre	48. 42. 9	54. 18. 21

Latitude by Account 50°. 44′ Sec. = 0.19864

⊙'s Declination 21. 30 Sec. = 0.03132

48°. 42′ Log Ratio .22996

54. 18

$$\left.\begin{array}{l}\text{Sum } 103.\ \ 0\\ \text{Diff. } 5.\ \ 36\end{array}\right\}\frac{1}{2}\left\{\begin{array}{l}51.\ 30'\ \text{Cosine} = 9.79415\\ 2.\ \ 48\ \text{Sine} = 8.68886\end{array}\right.$$

$\frac{1}{2}$ elapſed Time 22′. 30″ = 5°. 37′$\frac{1}{2}$ Coſ. = 11.00870

Arc 31. 47$\frac{1}{2}$ Sine = 9.72167

Co-Ar. N. Coſ. 26. 10 = 10248 its Log. = 4.01063

4

Time from Noon, when the greateſt Altitude was taken. } 1h 44′.40″

6035 = 3 78067

54°. 18′ Nat. Sine 81208

Mer. Alt. 60. 45 Nat. Sine 87243

90.

29. 15 Meridian Zenith Diſtance.

21. 30 Sun's Declination.

50. 45N. True Latitude of the Ship.

In the preceding Example it has been ſuppoſed, that both Altitudes were taken at the ſame Place; but as that can ſeldom happen at Sea, it is neceſſary to ſhew, how to correct one of the Altitudes, ſo as to make it what it would have been if obſerved at the ſame Place where the other was: and this may readily be done as follows:

Let the Bearing or Azimuth of the Sun's Centre be obſerved by the Compaſs at the inſtant of the firſt Obſervation: take the number of Points between it and the Ship's Courſe, corrected for Leeway, if ſhe makes any; with which, if leſs than eight, or with what it wants of 16 Points if more than eight, and the Diſtance run between the Obſervations, take the Difference of Latitude out of the Traverſe Table; which muſt be added to the firſt Altitude if the number of Points between the Sun's Bearing and Ship's Courſe were leſs than 8; but ſubtracted if more, and the firſt Altitude will be reduced to what it would have been, if obſerved at the ſame Place where the ſecond was.

NOTE.

The reſult of this Operation will be the Latitude of the Ship at the Time when the ſecond Altitude was taken, and muſt be reduced to Noon by means of the Log.

At Sea, June 1, 1791, in Latitude by Account 54°. 33′ N. Longitude 175° W. at 9h. 14′½ by Watch, the Altitude of the Sun's lower Limb was obſerved to be 45°. 5′. 57″ and the Azimuth of his Centre by the Compaſs SE by E ¼ E. and at 11h. 44′½ the obſerved Altitude of his lower Limb was 57°. 14′. 49″ the Obſerver's Eye being 16 feet above the Water. The Ship's Courſe between the Obſervations was N by E. at the rate of 6 Knots an Hour, and ſhe made no Leeway. What was the true Latitude of the Ship, at the Time of the latter Obſervation?

Here the Ship's Courſe N by E. being 9¾ Points from SE by E ¼ E. the Sun's Bearing at the firſt Obſervation, and being more than 8 Points, muſt be taken from 16 Points, leaves 6¼ Points; with this as a Courſe, and 15 Miles the Diſtance run between the Obſervations; find the

	° ′ ″		° ′ ″
Diff. of Lat. ſub.	— 5. —		
Alt. ☉'s LL. 1ſt Ob.	45. 5. 57		
1ſt Alt. reduced	45. 0. 57	Alt. ☉'s LL. 2d Ob.	57. 14. 49
Semi-diameter	15. 49		45. 49
Dip ſub.	3. 49		3. 49
Refraction ſub.	57		36
True Al. ☉'s Centre	45. 12. 0		57. 26. 13

Anſ. True Latitude 54°. 35′ N.

At Sea Sept. 12th, 1791, when the Sun had 3°. 56′ N. Declination, Latitude by Account at the Time of the latter Altitude 38°. 20′ S. at 11h. 14′ ½ A. M. by Watch; the Altitude of the Sun's lower Limb was obſerved 45° 56′ and the Azimuth of his Centre by Compaſs N by E ½ E. At 2h. 44′ ½ P. M. the Altitude of his lower Limb was 32°. 55′ and the Obſerver's Eye 16 feet above the Water. The Ship's Courſe during the interval was NW by N. with her Starboard Tacks aboard, at the Rate of 8 Miles an Hour, and ſhe made ¾ Point Leeway.

Required the true Latitude of the Ship at the Time of taking the latter Altitude?—*Anſ.* 38°. 25′ S.

TO REGULATE THE GOING OF A WATCH.

TO Regulate a Watch preparatory to taking the Obſervations neceſſary for determining the Longitude, is to find how much it goes faſt or ſlow of apparent Time, that it may be corrected.

APPARENT Time is that ſhewn by a good Sun-dial, or the Time found by two Altitudes of the Sun.

To find Apparent Time at Sea.

THE beſt method for doing this is by Double Altitudes, as it would be unneceſſary for a Ship to lay by, in order to determine the Time by equal Altitudes, when it may be done otherwiſe.

RULE.

IF the Time per Watch, and the obſerved Time, from Noon when the greateſt Altitude was taken, are both A. M. or P. M. their difference will be the Error of the watch; but if they are of contrary Names, their ſum will be the Error; and to know whether the watch is too faſt, or too ſlow of apparent Time; obſerve, that if the Time from Noon per Watch is before the obſerved Time, the Watch is too faſt; but if behind it, too ſlow.

EXAMPLES.

Time per Watch 11h. 40′ A.M. Obſerved Time when the greateſt Altitude was taken 11h. 50′. 40″. Required the Error of the Watch?

Time from Noon per Watch	20′.—″
Obſerved Time	9. 20
Watch too ſlow	10. 40 of App. Time.

Time fomr Noon per Watch when the greateſt Altitude was taken 7′. 30″ A. M. Obſerved Time 10°. 53″ A. M. What was the Error of the Watch?

Obſerved Time	10′. 53″ A. M.
Time per Watch	7. 30 A. M.
Watch too faſt	3. 23

ANOTHER METHOD.

Given the Latitude of a Place, Sun's Declination, and Altitude; to find the Apparent Time at that Place.

RULE.

When the Latitude and Declination are of the ſame Name, take their difference, but if of contrary Names their ſum, and add it to, and ſubtract it from, the true Zenith diſtance of the Sun, and take half the ſum, and half the difference: Then, to the Secants leſs Radius of the Latitude and Declination, add the Log Sines of half the ſum, and half difference, half the ſum of theſe Logarithms,

rithms, is the Sine of an Arc, which doubled, and converted into Time, gives the Apparent Time from Noon, when the obſervation was made.

EXAMPLES.

At Goſport, Latitude 50°.48 N. at 11h. 40′ A. M. per Watch, I found the true Altitude of the Sun's Centre 58°.30′ when he had 20° N. Declination. What was the Error of my Watch?

Latitude	50°. 48′	Co-Ar.	=	0.19926
Declination	20.		=	0.02701
Diff.	30. 48			
☉'s Zenith Diſt.	31. 30			
Sum	62. 18	½ = 31°. 9′ Sine	=	9.71373
Diff.	42	½ = 21 Sine	=	7.78594
			2)	17.72594
Arc	4°. 11′	Sine		8.86297
	2			
	8. 22			
	4			
App. Time from Noon	33′. 28″	A. M.		
Time per Watch	20.	A. M.		
Watch too faſt	13. 28	of App. Time.		

At Sea May 9th, 1791, in Latitude 39°. 48′ S. Longitude 90°. 30′ E. by Account, about 9h. 44′¾ A. M. the Altitude of the Sun's upper Limb was 24°. 18′ the Eye of the Obſerver being 19 Feet above the Water. What was the Error of the Watch?—*Anſ.* Watch too faſt, 11′. 21″.

LONGITUDE

BY THE

LUNAR OBSERVATION.

THE finding the Longitude of any Place reſults from the the Solution of this

PROBLEM.

SUPPOSE you were under any unknown Meridian, and had the Time relative to that Place given; to find what o'Clock it is, at that inſtant, under the Meridian of ſome known Place, as Greenwich, or Paris.

THE general and approved Method for doing this, is, by obſerving the Diſtance between the Moon and Sun, or between the Moon and ſuch Stars as lay directly in her Path; taking the Altitudes of the ſaid Objects, nearly at the ſame inſtant of Time, their Diſtance was obſerved: and here to be accurate, as a ſmall Error in the Diſtance will cauſe a great one in the Longitude, it will be better to repeat the Obſervations, till five or ſix Diſtances and their correſponding Altitudes are obtained; then the Sum of the Diſtances, divided by their Number, gives the mean Diſtance:

Diſtance; in like manner the mean Altitudes, and mean Time by the Watch are obtained. From ſuch neceſſary precautions, the Longitude may be obtained very near the truth.

THESE Obſervations muſt all be included within the ſpace of a Quarter of an Hour, or thereabouts.

THE principal Obſervation, is that of taking the Diſtance between the Moon, and Sun, or Star.

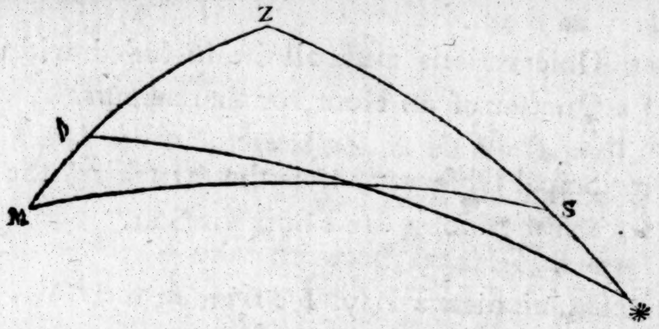
THE beſt time of the Day, for taking the Diſtance between the Moon and Sun; is from about half an Hour after Sun-riſe to about 10 o'Clock A. M. and if P. M. from about 2 o'Clock to within half an Hour of Sun-ſet: theſe Celeſtial Objects may be uſed during the four Days preceding the Moon's firſt Quarter, and four Days following the laſt Quarter.

THE beſt time for obſerving the Diſtance between the Moon and a Star, is, during the Morning or Evening Twilight; or when the Sea Horizon can be ſeen diſtinct enough to take an Altitude ſufficiently accurate.

Given the Apparent Altitudes of the Centres of the Moon and Sun (or a known fixed Star) with the apparent Diſtance of their Centres: to find the true Diſtance of their Centres at the Time of Obſervation; and from thence the Difference of Longitude.

LET Z be the Zenith of the place of Obſervation, M the apparent place of the Moon, and S that of the Star; and ☽ and ✱ their true places; then M ☽ is the Moon's

Parallax leſſened by Refraction, and S ✱ is the Star's Refraction it having no Parallax. And it will eaſily appear from the Figure, that neither Parallax nor Refraction can alter the Angle Z; for the Moon, whether ſeen at M or ☽ and the Star, whether ſeen at ✱ or S, will be on the ſame Azimuth Circles; therefore only affected in their Altitudes, which affects their Diſtance; and this difference between the true and apparent Diſtance can never exceed a Degree.



To find the true Diſtance.

1. With the obſerved Altitudes of the two Objects, find their apparent and true Altitudes; alſo find their apparent Diſtance.

2. Take the difference of the apparent Altitudes, and add it to, and ſubtract it from, the apparent Diſtance, and take half the ſum and half the remainder.

3. To the Secants leſs Radius of the apparent Altitudes, add the Sines of the $\frac{1}{2}$ ſum and $\frac{1}{2}$ remainder, and the Coſines of the true Altitudes; half the ſum of theſe Logarithms, rejecting 10 in the Index, is the Sine of an Arc.

4. To this Arc, add; and from it ſubtract; half the difference of the true Altitudes, and find the Coſines of the ſum and difference; then half the ſum of theſe Logarithms, will be the Coſine of half the true Diſtance.

5. In the Ephemeris among the Diſtances of the Moon's Centre from the Sun and fixed Stars on the Day of Obſervation; find thoſe two Diſtances of the Sun and Moon which are next leſs and greater than the true Diſtance; then ſay, as their difference : 3h. : : the Difference between the firſt of theſe Diſtances, and the computed Diſtance : the time elapſed ſince the time correſponding to the firſt Diſtance, which added thereto, gives the apparent time at Greenwich.

6. The Difference between the apparent Time at Greenwich, and the apparent Time at the Ship, turned into Longitude, gives the Ship's true Longitude from Greenwich Eaſt or Weſt, according as the Time at the Ship is greater, or leſs, than that at Greenwich.

EXAMPLES.

Admit the apparent Altitude of a Star was 24°. 48′, when that of the Moon's Centre was 12°. 30′, and their Diſtance 51°. 28′. 35″ the Moon's Horizontal Parallax being 56′. 15″. What was the true Diſtance?

	° ′ ″		
☽'s Hor. Parallax	— 56. 15	Sine =	8. 21381
☽'s App. Alt.	12 30. —	Sec. =	0. 01042
☽'s Par. in Alt.	54′. 55″	Sine =	8. 20339
Refraction ſub.	4. 13		
Correction	50. 42		

			° ′ ″
App. Alt. ☽'s Cent.	12. 30. —	App. Alt. *	24 48 —
Correction, add	50. 42	Refraction ſub	2. 3
True Alt. ☽'s Cent.	13. 20. 42	True Alt. *	24. 45. 57

*To find the True Diſtance ☽ from *.*

	° ′ ″		
Ap. Alt. *	24. 48. —	Secants.	= 0. 04202
Ap. Alt. ☽	12. 30. —		= 0. 01042
Diff.	12. 18. —		
Ap. Diſt.	51. 28. 35		
Sum	63. 46. 35	½ = 31.53.18 Sine	= 9.72285
Rem.	39. 10. 35	= 19.35.17 Sine	= 9.52538
True Alt. *	24. 45. 57	- - - Coſine =	9.95810
True Alt. ☽	13. 20. 42	- - - Coſine =	9.98811
Diff. Alts.	11. 25. 15		
		2 |	19.24688
Half	5. 42. 38		
Arc	24. 50. 46	- - - Sine =	9.62344
Sum	30. 33. 24	- - - Coſine =	9.93507
Diff.	19. 8. 8	- - - Coſine =	9.97532
		2 |	19.91039
	25. 35. —	- - - - Coſine =	9.95519
	2		
True Diſt.	51. 10. —		

2. Being at Sea, November 4th, 1791, in Longitude by Account 14° W. at 3h. 18′ P. M. per Watch well regulated; I obſerved the diſtance of Sun and Moon's neareſt Limbs to be 110°.1′.48″, the Altitude of the Sun's lower Limb being 10°.18′.43″, and that of the Moon's 64°.30′.15″

the Eye elevated 16 Feet above the Water. Required the true Longitude ?

	h. ′		
Ship's Time	3. 18		
Ship's Long. W.	56		
Time at Greenwich	4. 14 P. M.	Hor. Par.	57′. 12″.

Moon's Semidiameter	15′. 35″
Augmentation	14
☽ 's Aug. Semidiameter	15. 49

	Obſ. Diſ. ☉ à ☽.		Obſ. Al. ☽'s L.L.		Obſ. Al. ☉'s L.L.
	° ′ ″ 110. 1. 48		° ′ ″ 64. 30. 15		° ′ ″ 10. 18. 43
Semid. ☉	16. 12	-	-	-	16. 12
Semid. ☽	15. 49		15. 49		
		Dip Sub.	3. 49		3. 49
Ap. Diſt.	110. 33. 49	Ap. Alt.	64. 42. 15	Ap. Alt.	10. 31. 6
		Correction	23. 59	Dif. R & P. ſub.	4. 51
True Altitude ☽			65. 6. 14	T. Al. ☉	10. 26. 15

To find the True Diſtance ☽ *from* ☉.

Ap. Alt. ☽	° ′ ″ 64. 42. 15	Secants	=0.36928	
Ap. Alt. ☉	10. 31. 6		=0.00736	
	54. 11. 9			
Ap. Diſt	110. 33. 49			
Sum	164. 44. 58	½	=82. 22. 29	Sine = 9. 99614
Diff.	56. 22. 40		=28. 11. 20	Sine = 9. 67429

True Alt. ☽	65. 6. 14	- - Coſine =	9. 62426
True Alt. ⊙	10. 26. 15	- - Coſine =	9. 99276
Diff.	54. 39. 59		2)19. 66409
Half	27. 20. —		
Arc	42. 47. 9	- - Sine =	9. 83204
Sum	70. 7. 9	- - Coſine =	9. 53156
Diff.	15. 27. 9	- - Coſine =	9. 98402
			2)19. 51558
	55. 4. 27	Coſine =	9.75779
	2		
	110. 8. 54	True Diſtance.	

	° ′ ″		° ′ ″	h ′ ″
Diſt. at 3 Hours	109. 30. 24	- -	109. 30. 24	
Diſt. at 6 Hours	111. 1. 5	Co.Diſ.	110. 8. 54	
As	1. 30. 41 : 3h. ::		38. 30 :	1. 16. 25
				3.
		Time at Greenwich		4. 16. 25
		Time at Ship		3. 18. —
				4) 58. 25
		True Longitude		14°. 36¼ W

3. At Sea, October 13th, 1791, in Longitude by Account 95° E. the following Obſervations were made of the Diſtance of the Star Aldebaran from the Moon's

neareſt Limb: the Eye being 16 Feet above the Water. Required the true Longitude?

	App. Time P. M.	Alt. *	Alt. ☽'s L. L.	Diſtance ☽ á *	
	h. ′ ″	° ′ ″	° ′ ″	° ′ ″	
	9. 39. 40	30. 17. 10	50. 18. 30	28. 26. —	
	42. 18	25. 14	27. 14	27. 30	
	45. 30	34. 8	35. 0	28. 15	
	47. 41	43. 10	46. 0	30. —	
	51. 17	51. 8	55. 16	30. 45	
5	226. 26	170. 50	182. 0	142. 30	Sums
	9. 45. 17	30. 34. 10	50. 36. 24	28. 28. 30	Means.
Errors of the Quadrants.			add 4. 12	ſub. 14	
			50. 40. 36	28. 28. 16	

Anſ. True Longitude 94°. 58′ E.

4. At Sea, Novr. 2d, 1791, in Longitude by Account 24° W. having my Watch well regulated to Apparent Time; the following Obſervations were made of the Sun and Moon's neareſt Limbs, &c.

	Times by the Watch	Alt. ☉'s Upper L.	Alt. ☽'s L. L.	Diſtance ☽ and ☉	
	h ′ ″	° ′ ″	° ′	° ′ ″	
	6. 9. —	18. 49. 30	60. 24	86. 57 30	
	9. 24	49. —	29	56.	
	9. 54	48. 36	35½	55. 30	
	10. 22	48. —	40	55. —	
	10. 58	47. 48	46	54. 45	
	11. 22	47. 18	53½	54. —	
6	61.	290. 12	228	332. 45	
	6. 10. 10	18. 48. 22	60. 38. —	86. 55. 27	Means.
		+ 2. 22	+ 1. 30	— 2. 27	Er. of the Q.
		18. 50. 44	60. 39. 30	86. 53. —	Means corr.

The Eye being elevated 20 Feet above the Water. Required the true Longitude?

Anſ. True Longitude 24 33′ ¾W.

ON THE
VARIATION OF THE COMPASS.

THE Variation of the Compaſs is the Number of Degrees the North point of the Needle ſtands from the true North point of the Horizon, towards the Eaſt or Weſt.

THE Magnetic Amplitude of a Celeſtial Object, is its Bearing by the Compaſs when in the Horizon.

THE Magnetic Azimuth of an Object, is its Bearing by the Compaſs when above the Horizon; and is beſt taken when its Altitude is any number of Degrees between 5 and 20.

IT is abſolutely neceſſary to know the Variation of the Compaſs at Sea, in order to correct the Courſes a Ship has ſteered.

THE Variation is found by comparing together, the true and Magnetic Amplitudes or Azimuths.

LEEWAY, Magnetic Amplitude and Azimuth, are taken with the Azimuth Compaſs.

Nautical Obſervations.

1. WHEN the true and Magnetic Amplitudes or Azimuths agree, there is no variation; but if they differ, as moſt commonly they do, their difference will be the variation.

2. WHEN the true and obſerved Amplitudes are of the ſame Name, their difference is the Variation; but if of contrary Names, their Sum will be the Variation.

3. Again, let the true and obſerved Azimuths be both reckoned from the elevated Pole: then if they are both on the ſame ſide of the Meridian, their difference will be the Variation; but if they are on contrary ſides, their Sum is the Variation: and to know whether the Variation is Eaſterly or Weſterly, obſerve this

GENERAL RULE.

Let the Obſerver ſuppoſe himſelf in the Centre of the Horizon with his Face turned towards the Sun: then, if the true Amplitude or Azimuth be to the Right-hand of the Magnetic, the Variation is Eaſt; but if to the Left-hand, Weſt.

To find the Variation of the Compaſs by an Amplitude.

To find the true Amplitude.

RULE.

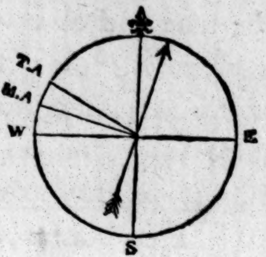
To the Sine of the Object's Declination, add the Secant leſs Radius of the Latitude, the Sum is the Sine of the true Amplitude of the ſame Name with the Declination.

EXAMPLES.

At Sea in Latitude 49° 34′ S. when the Sun had 19° 40′ N. Declination, and he ſet W. 17° N Required the Variation of the Compaſs, and which way?

	° ′	
Sun's Declination	19. 40	Sine = 9. 52705
Latitude	49. 34	Secant = 0. 18805
True Amp.	W. 31. 16 N.	Sine = 9. 71510
Mag. Amp.	W. 17. N.	
Variation	14. 16 E.	

Being



Being at Sea in Latitude 39° 19′ N. on the 21ſt December, I obſerved the Sun's Magnetic Amplitude at riſing to be E. 23° S. Required the Variation of the Compaſs?

Anſ. Variation 7° 59′ E.

At Sea in Latitude 50° 48′ N. Sun's Declination 16° 8′ N. and his obſerved Amplitude at ſetting W. 30° N. What was the Variation of the Compaſs, and which way?

Anſ. Variation 3° 55′ W.

At Sea in Latitude 51° 50′ S. Sun's Declination 10° 18′ N. and he roſe E. 3° 30′ S. What was the Variation?

Anſ. Variation 16° 19′ W.

At Sea in Latitude 35° N. Sun's Declination 10° S. and he was obſerved to ſet W by N. What was the Variation?

Anſ. 23° 29′ W.

TO FIND THE VARIATION OF THE COMPASS BY AN AZIMUTH.

To find the true Azimuth; having the Latitude, Sun's Declination and Altitude.

RULE.

TAKE ½ the Difference between the Latitude and Altitude, and add it to, and ſubſtract it from ½ the Polar diſtance. Then, to the Secants leſs Radius of the Latitude and Altitude, add the Sines of the Sum and Difference; ½ the Sum of theſe Logarithms is the Sine of an Arc, which doubled, gives the true Azimuth of the Object from the elevated Pole.

NOTE.

WHEN the Latitude and Declination are of the ſame Name, ſubtract the Declination from 90°; but when of contrary Names, take their Sum for the Polar Diſtance.

EXAMPLES.

AT Sea in Latitude 41° 30′ N. when the Sun's Declination was 17° 30′ N. and his true Altitude 14° 44′ bearing by the Compaſs N, 61° 53′ E. Required the Variation?

° ′
Latitude 41. 30 } Secant { =0. 12554
90° Altitude 14. 44 } Secant { =0. 01452
⊙'s Decl. 17. 30 N. 2) 26. 46
P. Diſt. 72. 30 = 13. 23
2 36. 15
Sum 49. 38 } Sine. { =9. 88191
Diff. 22. 52 } Sine. { =9. 58949
2) 19. 61146
39. 45 Sine = 9. 80573
2

True Azimuth N. 79. 30 E.
Magnetic Az. N. 61. 53 E.
Variation 17. 37 E.

Being at Sea in Latitude 44° 34′ S. when the Sun had 11° 19′ S. Declination, his true Altitude being 9° 48′ and Magnetic Azimuth SWbW. Required the Variation of the Compaſs?

Anſ. Variation 7°. 3′ E.

At Sea in Latitude 59° 18′ S. Sun's Declination 20°S. true Altitude 16° 38′ and Bearing by the Compaſs WbN½W. Required the Variation of the Compaſs?

Anſ. Variation 16° 55′ W.

In Latitude 44° 33′ S. when the Sun's true Altitude was 13° 39′, his Azimuth by the Compaſs was EbN and Declination 11° 12′ N. Required the Variation?

Anſ. Variation 20° 3′ W.

Being at Sea, Funchal in Madeira Latitude 32° 38′ N. bore SSW. Diſtance 171 Miles. I obſerved the Azimuth of the Sun's Centre to be WNW, when his true Altitude was 12° 27′ and Declination 18° 23′ N. Required the Variation?

Anſ. Variation 8° 40′ W.

How to Correct Courſes and Bearings.

Leeway and Variation (if there be any) muſt be allowed upon all Courſes ſteered; but the Variation only, upon all Bearings, that are taken by the Compaſs: and here you muſt ſuppoſe yourſelf placed in the Centre thereof, and looking directly forward to the Points you are to allow them from.

1ſt. *To correct for Leeway.*

1. Leeway is an Angle which the Ship's real Courſe makes with her intended Courſe, occaſioned by contrary Winds, and a rough Sea.

2. When a Ship turns to Windward, or is cloſe hauled on a Wind, ſhe generally runs to the Leeward of her intended Courſe; except when the Water is ſmooth, and a moderate Gale.

3. When a Ship endeavours to ſail towards that Point of the Compaſs from whence the Wind blows, ſhe is ſaid to ſail on a Wind, or to ply to Windward.

4. When a Ship ſails the ſame way the Wind blows, ſhe is ſaid to have the Wind right Aft, or to run before the Wind.

5. When a Ship ſails with the Wind blowing directly acroſs her, ſhe is ſaid to have the Wind on the Beam, and her Courſe is 8 Points from it; in which caſe we ſay, ſhe keeps her Wind.

6. When the Wind blows obliquely acroſs the Ship it is ſaid to be afore or abaſt the Beam, according as her courſe is leſs, or more than 8 Points from the Wind: and in the firſt Caſe, we ſay, ſhe goes or gets upon the Wind; but in the latter, ſhe goes large, or runs from the Wind.

NOTE.

In a Ship, looking towards her Head, Starboard, ſignifies the Right-hand ſide.—Larboard, the Left-hand ſide.

RULE.

Leeway muſt always be allowed to the Righ-hand of the Courſe ſteered, when the Larboard Tacks are aboard; and to the Left-hand, when the Starboard Tacks aboard.

Tacks and Sheets, are large Ropes made faſt to the lower corners of the fore and main Sails, by which either of theſe corners are hauled fore or aft.

General Allowances for Leeway.

1. Close hauled, all Sails ſet and a moderate Gale — — — 0
2. Blows freſh, ſmall Sails taken in — 1
3. Top-ſails cloſe reeft — — 2
4. One Top-ſail handed — — 2½
5. Main Top-ſail handed — — 3
6. Both Top-ſails taken in — 3½
7. Fore-courſes handed — — 4
8. Trying under Main-ſail only — 5
9. Main and Fore-courſes taken in, or trying under the Mizen only — 6
10. Trying under bare Poles 7

Points Leeway.

11. Lying too under a Main-ſail, Mizen, &c. obſerve how the Ship comes up, and falls off, and take the Middle between the two Points for the Ship's Courſe, from which allow for Leeway and Variation.

NOTE.

The generality of Ships will lie within about 6 Points of the Wind, but Sloops and ſome other Veſſels much nearer.

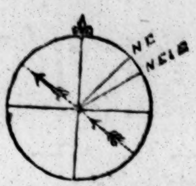
EXAMPLES.

1. Suppose I ſteer NEbE with my Starboard-tacks aboard, and make 1 Point Leeway. Required the Courſe made good?

Courſe ſteered NEbE 5 Points.
Leeway 1 Point Left-hand.

Courſe made good NE = 4 Points.

2. Steer-



2. **Steering** by the Compaſs NWbN, the Wind at WbS, with both Top-ſails taken in. Required the true Courſe?

Anſ. N $\frac{1}{2}$ E.

3. **Course** by the Compaſs N $\frac{3}{4}$ W. Wind at WNW $\frac{1}{4}$ W. there being 1$\frac{3}{4}$ Points Leeway. What was the true Courſe?

Anſ. N by E.

4. A **Ship** lying too under a Main-ſail with her Starboard tacks aboard, comes up E by S. and falls off to NE by N. What was her true Courſe?

Anſ. N by E.

II.

To correct for Variation.

RULE.

When the Variation is Eaſterly, it muſt be allowed to the Right-hand of the Courſe ſteered; but if Weſterly, to the Left-hand of the Courſe or Bearing, for the true Courſe or Bearing required.

EXAMPLES.

1. **Steering** by the Compaſs NW by N. when the Variation was 1$\frac{1}{2}$ Points Eaſt. What was the true Courſe?

Courſe ſet N W by N.	3	Points.
Variation	1$\frac{1}{2}$	E.
Courſe corrected N by W $\frac{1}{2}$ W. =	1$\frac{1}{2}$	Points.

2. Course by the Compaſs S by W. Variation 1¾ Points W. What is the true Courſe?

Anſ. S ¾ E.

3. Suppose I try a Current, and find it ſets N W by N. by the Compaſs, there being 1½ Points Weſterly Variation. Required the true way the Current ſets?

Anſ. N W ½ W.

4. Steering E. by the Compaſs when the Variation was 1¼ Points Eaſt. What was the true Courſe?

Anſ. E S E ¼ E.

5. Suppose their is a great Sea, heaving towards the S E by E. by the Compaſs, there being ¾ Point Eaſt Variation. Required the true way the Water Heaves?

Anſ. S E ¼ E,

6. At Sea we ſaw the Needles bearing by the Compaſs N by E ½ E. when the Variation was 1¾ Points Weſt. Required their true Bearing?

Anſ. N ¼ W.

NOTE.

When you want the Courſe to ſteer by the Compaſs, having the true Courſe from place to place given; apply the Variation the contrary way: *i. e.* if the Variation is E. call it W. if W. call it E. and correct as above.

True Courſe from place to place N E by E. and there is 1¼ Points Weſterly Variation. Required the Courſe by the Compaſs: ſuppoſing the Ship makes no Leeway?

Courſe from place to place N E by E. 5 Points.
Variation 1¼ E.
—
Courſe by the Compaſs E N E ¼ E. = 6¼ Points.
—

III.

Given the Courſe by the Compaſs, Leeway and Variation; required the true Courſe.

RULE.

CORRECT for Leeway, and then allow for Variation, and you will have the true and correct Courſe required.

EXAMPLES.

1. SAILING N. with the Wind at E N E. there being 3 Points Leeway, and 1½ Points Eaſterly Variation. Required the true Courſe?

Courſe by the Compaſs	0
Leeway	3
Courſe corrected for Leeway	3
Variation	1½ E.
True Courſe N by W ½ W =	1½ Points

2. Courſe by the Compaſs N E ½ E. Wind at S E. there being ½ Point Leeway, and ¼ Point Eaſterly Variation. Required the Courſe corrected?

Anſ. N E ¾ E.

3. SAILING S W. with our Starboard tacks aboard, and Top-ſails cloſe reeft, the Compaſs having 1¾ Points Weſterly Variation, What was the true Courſe?

Anſ. S ¼ W.

4. A SHIP lying too under a Main-ſail, with her Larboard tacks aboard, comes up N W by N. and falls off to N by E. there being 1 Point Eaſt Variation. What was her true Courſe?

Anſ. N E by E.

ON
KEEPING THE ACCOUNT
OF A
SHIP's VOYAGE.

H
co
to
ſh

cu
an

co
uſe
ke

wh
ſig
he
tur
be
is g
tim
ing
me
the
Poi
plac
Alſ
ted

On KEEPING *the* ACCOUNT *of a* SHIP'S VOYAGE.

BY keeping a Journal at Sea, is meant and exact Account of the Ship's Way, that at any time you may be able to know the Ship's Place, or what Latitude and Longitude ſhe is in.

THE Journal alſo contains the remarkable daily Occurrences relating to the Ship, during her Voyage out, and home.

THERE are various Methods of keeping a Journal according to the Taſte of thoſe who keep it, yet all muſt uſe the long form, before they can make an Abſtract, or keep it after a ſhorter Method which ſome prefer.

USEFUL REMARKS.

1. WHEN a Ship is bound from one place to another, which lies ſo far from her, that ſhe is obliged to go out of ſight of Land for ſome conſiderable time; at the time of her leaving ſight of Land, ſhe is ſaid to take her Departure, and that part of the Land ſhe then leaves, is ſaid to be the Place ſhe takes her Departure from, which with us, is generally the Lizard or the Land's End: And, at the time of taking ſuch Departure, the Mate takes the Bearing and Diſtance of that Land, according to his Judgment, and ſets it down on the Log-board, againſt the the Time it was taken.—This Diſtance, with the oppoſite Point to the Bearing corrected for Variation, muſt be placed in the Traverſe Table, as a Courſe and Diſtance.—Alſo when you make the Land, the Bearing itſelf corrected for Variation, and the Diſtance you are from it, are to

be ſet down in like manner as before: then if the Latitude and Longitude of the Ship by Account, agree with that of the given Place; it will be a convincing proof that your Reckoning is juſt.

2. The Log-Book is an exact Copy of the Log-Board, into which it is tranſcribed every Day at Noon; and from thence the neceſſary Deductions are to be made relative to the Ship's Place.

3. In the Log-Book under the Log of every Day, are Columns for Courſe, Diſtance, difference of Latitude and Departure made the laſt 24 Hours, that is, from the Noon of the Day before, to the Noon of the Day you work on. Latitude in by Dead Reckoning, Latitude by Obſervation, if the Weather permit, if not, leave it open. Meridianal Diſtance, or how much Departure you have made in all, ſince leaving the Place you took your Departure from. Longitude in by Account; and in the laſt, the Bearing and Diſtance of the Land, (or Place bound to) that Day at Noon, all which may be found with the greateſt Eaſe.

Rules for correcting the Dead Reckoning by an Obſervation.

When you have made the proper Allowances for Leeway, Variation, Currents, and Error in the Diſtance, which may be detected by examining the Log and Half Minute Glaſs, and your Latitude by Account agrees with the Latitude by Obſervation, it is preſumed the Ship's Place is well determined.—But, as it ſometimes happens from unknown accidents, after theſe Corrections have been made, that your Latitude by Account will not agree with your Latitude by Obſervation within 5 Miles, then it is neceſſary, that proper Corrections be made in the Account of Longitude, and for the Latitude, that found by Obſervation, is always to be depended on.

THE following is an Example where an Error in the Diſtance corrects the Latitude by Account; and then, the difference of Longitude is found either by Middle Latitude, or Mercator's Sailing.

YESTERDAY Noon we were in Latitude 41° 40′ N. and by Obſervation this Day Noon we are in Latitude 39° 9 N. having by Account made 140 Miles of Southing, and 84 of Eaſting. Required the true difference of Longitude?

Latitude left	41° 40′ N.	
X. Latitude by Acct.	2. 20 S.	
Latitude in by D.R.	39. 20 N.	diff. 11 Miles.

from the true Latitude by Obſervation.—Therefore I examine the Log line and Half Minute Glaſs, and find that the Log meaſures 54 feet between Knot and Knot, and the Glaſs true; hence I correct my difference of Latitude and Departure, by Caſe 11, Page 62, thus;

140	84
54	54
5.0)756.0	5.0)453.6

Corrected X. Latitude 151.2 S. Corrected Dep. 90.72W.

Now from Latitude left	41° 40′ N.
Take X. Lat. corrected for Error in Diſt.	2. 31 S.
Latitude in, corrected.	39. 9 N.

agreeing exactly with the Latitude by Obſervation, therefore I conclude that my Reckoning is juſt, and the difference of Longitude found by Mercator's Sailing = 118.8 Miles.

The Rules uſed for Correcting the Longitude in other Caſes are the two following.

I.

When the Courſe by Account is more than three Points, and leſs than five Points, the Error is in the Courſe and Diſtance.

RULE.

With the difference of Latitude and Departure by Account, find a Diſtance. With this Diſtance and difference of Latitude by Obſervation, find another Departure: then, with half the Sum of this Departure, and Departure by Account (which call the true Departure,) and the difference of Latitude by Obſervation, find the true difference of Longitude.

NOTE.

When the Ship's Courſe is leſs than three Points, the Error is in the Diſtance; but as this cannot affect the Courſe, the difference of Longitude is found by the uſual method.

II.

When the Courſe by Dead Reckoning is more than five Points, the Error is in the Courſe only.

RULE.

With the difference of Latitude and Departure by Account, find a Diſtance; then, with this Diſtance and difference of Latitude by Obſervation find a Courſe, with which and the Meridianal difference of Latitude between the Obſervations, find the true difference of Longitude.

*** The two preceding Rules may always be depended on for correcting any ſingle Day's Work. But when it ſo happens that an Obſervation has been wanted for ſeveral Days, then mark the Latitude and Longitude at the laſt Obſervation; or, if it be the firſt ſince leaving the Land, mark the Latitude and Longitude of the Land you left, which are the only things you can call certain; all the other parts of the Reckoning muſt undergo a Correction.

To Correct for ſeveral Days.

RULE.

Make a Traverſe Table of the whole of the Northing and Southing, Eaſting and Weſting, ſince your laſt Obſervation, taking care not to omit the difference of Latitude and Departure of the Day you correct on, and you will have the whole difference of Latitude and Departure ſince your laſt Obſervation; with which find a Courſe, and obſerve which of the above Caſes it falls under, and correct by it accordingly.

It will now be neceſſary for the Learner to know how to work a few ſeparate Day's Works before he proceeds to the keeping of a Journal of ſeveral ſucceſſive Days; and here I ſhall be brief, for if he underſtands what he has already gone through, no difficulty can ariſe in working theſe or any other Examples of the like Nature.

ON

SEPARATE DAYS WORKS.

A DAY'S Work, is the ſame as reſolving a Compound Courſe or Traverſe, wherein ſeveral Courſes and Diſtances have been run in a Day, to reduce them to one Courſe and Diſtance called the direct Courſe and Diſtance: and here, before we can do this, the ſeveral Courſes muſt be corrected for Leeway or Variation.

A DAY, according to the Civil reckoning of Time, is made from Midnight to Midnight; ſo that Noon, or the Time of the Sun's coming to the Meridian, is the middle of the Day.

NAVIGATORS end the Day at Noon of the Civil Day, for the Convenience of comparing the Latitude by Account with the Latitude by a Meridian Obſervation; and are a whole Day before the Aſtronomers, whoſe Day of the ſame Date is juſt beginning when the Navigators ends. Aſtronomers generally reckon through the 24 Hours, from Noon to Noon.

To Work a Traverſe; or, to reduce Compound Courſe to a ſingle One.

RULE.

1. MAKE a Table of ſix Columns, Title them Courſes corrected, Diſtance, N. S. E. W. and write the given Courſes corrected, and Diſtances taken from the Log-board into their reſpective Columns.

2. Look into the Traverſe Table for each Courſe and Diſtance, and take out their correſponding difference of Latitude and Departure, and write them in their proper Columns.

3. Then the difference between the Sums of the N. and S. Columns, gives the whole difference of Latitude of the ſame Name with the greater; alſo the difference between the Sums of the E. and W. Columns will be the whole Departure, of the ſame Name with the greater; then proceed by Prob. III. Mercator's Sailing for the completing of your Day's Work; and for the Bearing and Diſtance of the Place bound to by Prob. I.

NOTE.

1. Whenever you ſuſpect a Current, let the Setting and Drift be taken per Hour, and likewiſe the Time you ſuppoſe you have been in it, and ſet both down in your Traverſe Table as a Courſe and Diſtance.

2. The Heave or Swell of the Sea, for which we generally allow one Mile in every 10 given by the Log, muſt be ſet down in the ſame manner as Currents.

3. In the following Day's Works and Journal, 10 Fathoms are accounted for one Knot; alſo,

H. ſtands for Hours,
K. ——— Knots, and
F. ——— Fathoms.

EXAMPLES.

1. Yesterday Noon we were in Latitude 40° N. Longitude 74° 50′ W. and have ſailed till this Day Noon, as per Log. Required the Ship's place and direct Courſe and Diſtance made good?

LOG BOARD.

H.	K.	F.	Courſes.	Winds	LW.	Remarks, &c.
1	6	4	NNE.	W.		
2	4	8				
3	7	2				
4	6	4				
5	6	2				
6	6	4	ENE.	NW.		
7	6	2				
8	6	8				
9	7	2				
10	6	4				
11	5	9				
12	6	4	E by S.	N.		
1	6	8				
2	6	6				
3	6	4				
4	6	3				
5	6	7				
6	7	—	SSE.			
7	4	6				
8	4	8				
9	4	7				
10	5	—				
11	6	—				
12	6	—				

THE Courſes and Winds in the Log-board being examined, it appears that the Ship goes large, conſequently has no Leeway; therefore the ſeveral Courſes from the Log-board are to be entered in the Traverſe Table without Alteration.

NEXT the Fathoms and Knots belonging to each Courſe are to be ſummed up, and the reſults put in the Column of Diſtances, oppoſite their reſpective Courſes; then proceed by Rule.

Traverſe Table.

Courſes Corrected.	Diſt.	N.	S.	E.	W.
NNE.	31	28. 6	—.—	11. 9	—.—
ENE.	38	14. 5	—.—	35. 1	—.—
E by S.	39	—.—	7. 6	38. 2	—.—
SSE.	38	—.—	35. 1	14. 5	—.—
		43. 1	42. 7	99. 7	Departure
		42. 7			
Difference Lat.		. 4			

HERE, from the Reduction of the Traverſe, it appears that the Ship has made no Latitude; conſequently her Departure and Diſtance are the ſame, and her direct Courſe E. Therefore we have nothing to do but to find the difference of Longitude when the Ship ſails upon a Parallel, thus:

As Coſine Lat. 40° = 0.11575
: Radius 90° = 10. Long. left 74° 50′ W.
: : Diſtance 99.7′ = 1.99869 Diff. L. 130′ = 2. 10 E.
: Diff. Long. 130.2′ = 2.11444 Preſ. Long. 72. 40 W.

Anſ. Direct Courſe E. Diſtance 99·7 Miles. Preſent Latitude 40° N. Longitude 72° 40′ W.

2. YESTERDAY Noon we were in Latitude 44° 11′ N. Longitude 5° 54′ W.; and we have ſailed till this Day Noon as per Log. Required the Courſe and Diſtance made good, with the preſent Latitude and Longitude of the Ship.

LOG BOARD.

H.	K.	F.	Courſes.	Winds	L.W.	Remarks, &c.
1	4	—	NWbW.	SWbW	2	Wind blowing hard, took in the Fore-top Sail.
2	4	6				
3	4	7				
4	5	6				
5	4	3				
6	2	8				
7	3	—	NW.	WSW	3	Wind increaſing with a high Sea, handed the Main-top Sail.
8	4	3				
9	3	8				
10	2	2				
11	3	—				
12	5	—				
1	4	4	— —	—	2	More moderate.
2	3	2				
3	3	7				
4	5	—				
5	4	3				
6	6	4				
7	4	4	NWbyN.	WbyS.	3 ½	Saw a Snow to the Weſt.
8	4	7				
9	3	2				
10	4	6				
11	4	—				
12	4	3				Variation 1 Point Weſt.

The Courſes being firſt corrected for Variation and Leeway the Traverſe Table will ſtand thus:

Traverſe Table.

Courſes Corrected.	Diſt.	N.	S.	E.	W.
NW.	26	18. 4	——	——	18. 4
NNW.	21	19. 4	——	——	8.—
NW by N.	27	22. 4	——	——	15.—
N ½ W.	25	24. 9	——	——	2. 4
Diff. Latitude		85. 1		Departure	43. 8

HAVING found the whole difference of Latitude and Departure, the direct Courſe, Diſtance, and difference of Longitude, are found by Prob. III. Mercator's Sailing.

Anſ. Courſe N. 27° 14′ W. Diſtance 95.71 Miles.
Preſent Latitude 45° 36′ N. Longitude 6° 56′ W.

3. BEING Yeſterday Noon in Latitude 45° 33 N. Longitude 11° 37′ W. and we have ſailed till this Day Noon as per Log, the Tide having all that time ſet S by E. at the rate of 1¾ Miles an Hour. Required the Courſe and Diſtance made good, preſent Latitude and Longitude of the Ship, with the Bearing and Diſtance of Cape Finiſterre?

LOG BOARD.

H.	K.	F.	Courſes.	Winds	LW	Remarks, &c.
1	4	3	S by E.	SW by W.	1	Handed Top-gallant Sails.
2	5	6				
3	3	2				
4	4	—				
5	3	2	S S E.		0	Ship goes large.
6	4	4				
7	3	6				
8	2	4				
9	3	2				
10	1	3				
11	2	—				
12	4	1	S by W.	WbyS.	2½	
1	3	2				
2	4	4				
3	3	8				
4	2	5				Tack'd Ship.
5	4	2	NWbN.		1¾	
6	5	1				
7	2	7				
8	3	5				
9	4	1				
10	3	2				
11	3	4				Variation 1¼ Points Weſt.
12	3	8				

Anſ. Courſe S. 38° 31′ E. Diſtance 65·06 Miles. Preſent Latitude 44° 42′ N. Longitude 10° 40′ W. and Cape Finiſterre bears SSE ½ E. 125·1 Miles.

4. YESTERDAY Noon we were in Latitude 40° 48′ N. Longitude 14° 21′ W. and at 7 P. M. the Sun ſet by the Compaſs W. 42° 59′ N. and we have ſailed till this Day

Noon, as per Log, in a Swell from the NE by N. for which we allow 12 Miles in 24 Hours. Required the Courſe and Diſtance made good, the Ship's Place, with the Bearing and the Diſtance of Cape St. Vincent.

LOG BOARD.

H.	K.	F.	Courſes.	Winds	LW	Remarks, &c.
1	6	3	S by W.	WbS.	0	Moderate Gales.
2	4	2				
3	5	3				
4	6	—				
5	7	4				
6	6	—				
7	4	3	S S W.	E.	$\frac{1}{2}$	Sun ſet W. 42°. 59′ N.
8	5	7				Latitude 40°. 48′ N.
9	6	4				Declination 19°. 40 N.
10	7	2				
11	8	4				
12	4	4	—	NWby N.	0	Ship goes large.
1	3	3				
2	6	—				
3	4	5	— —	—	—	Stiff Gales.
4	3	8				
5	4	5	SWbyW	NWby W.	$\frac{1}{4}$	In firſt reef Fore-top ſail.
6	6	3				
7	7	—				
8	4	8				
9	5	8	Veer'd	Ship		
10	6	—	N by E.	—	$\frac{1}{4}$	
11	4	2				
12	4	8				

Anſ. Direct Courſe S. 10° 22′ W. Diſtance 109½ Miles. Preſent Lat. 39° N. Longitude 14° 47′ W. Cape St. Vincent bears S. 66° 30′ E. Diſtance 296 Miles.

LOG BOARD.

H.	K.	F.	Courſes.	Winds	LW	Remarks, &c.
1	4	3	S by E.	SW by W.	1	Handed Top-gallant Sails.
2	5	6				
3	3	2				
4	4	—				
5	3	2	S S E.		o	Ship goes large.
6	4	4				
7	3	6				
8	2	4				
9	3	2				
10	1	3				
11	2	—				
12	4	1	S by W.	WbyS.	2½	
1	3	2				
2	4	4				
3	3	8				
4	2	5				Tack'd Ship.
5	4	2	NWbN.		1¾	
6	5	1				
7	2	7				
8	3	5				
9	4	1				
10	3	2				
11	3	4				Variation 1¼ Points Weſt.
12	3	8				

Anſ. Courſe S. 38° 31′ E. Diſtance 65·06 Miles. Preſent Latitude 44° 42′ N. Longitude 10° 40′ W. and Cape Finiſterre bears SSE ½ E. 125·1 Miles.

4. YESTERDAY Noon we were in Latitude 40° 48′ N. Longitude 14° 21′ W. and at 7 P. M. the Sun ſet by the Compaſs W. 42° 59′ N. and we have ſailed till this Day

Noon, as per Log, in a Swell from the NE by N. for which we allow 12 Miles in 24 Hours. Required the Courſe and Diſtance made good, the Ship's Place, with the Bearing and the Diſtance of Cape St. Vincent.

LOG BOARD.

H.	K.	F.	Courſes.	Winds	LW	Remarks, &c.
1	6	3	S by W.	WbS.	o	Moderate Gales.
2	4	2				
3	5	3				
4	6	—				
5	7	4				
6	6	—				
7	4	3	S S W.	E.	½	Sun ſet W. 42°. 59′ N.
8	5	7				Latitude 40°. 48′ N.
9	6	4				Declination 19°. 40 N.
10	7	2				
11	8	4				
12	4	4	—	NWby N.	o	Ship goes large.
1	3	3				
2	6	—				
3	4	5	— —	—	—	Stiff Gales.
4	3	8				
5	4	5	SWbyW	NWby W.	¼	In firſt reef Fore-top ſail.
6	6	3				
7	7	—				
8	4	8				
9	5	8	Veer'd	Ship		
10	6	—	N by E.	—	¼	
11	4	2				
12	4	8				

Anſ. Direct Courſe S. 10° 22′ W. Diſtance 109½ Miles. Preſent Lat. 39° N. Longitude 14° 47′ W. Cape St. Vincent bears S. 66° 30′ E. Diſtance 296 Miles.

5. YESTERDAY Noon we were in Latitude 44° 53′ N. Longitude 10° 30′ W. and at 7 A. M. this Morning we were in Latitude 43° 18′ N. the Sun's Altitude at that time 17° 57′ and bearing by the Compaſs E. 19° 39′ S. and we have ſailed till this Day Noon as per Log, in a Tide ſetting SSE ¼ E. at the rate of two Miles an Hour. Required the Courſe and Diſtance made good, Ship's Place, with the Bearing and Diſtance of Oporto?

LOG BOARD.

H.	K.	F.	Courſes.	Winds	L W	Remarks, &c.
1	4	3	SWbyW	NWby	1½	Ship upon the Wind, and
2	5	2		W.		ſmall Sails handed.
3	4	6				
4	4	4				
5	4	4				
6	4	4	W by S.	NWby	2	Wind blowing hard, took
7	4	—		N.		in Main-top ſail.
8	3	8				
9	4	1				
10	4	7				
11	4	4	— —	—	1½	
12	4	8				
1	4	9				
2	4	8				
3	4	—				
4	4	4				
5	4	6				
6	4	—	— —	—	2½	Latitude 43° 18′ N.
7	4	2				Sun's Altitude 17° 57′.
8	4	3				Declination 10° 18′ N.
9	4	—				
10	4	2				
11	4	8				
12	4	4				

Anſ. Courſe S. 13° 37′ W. Diſtance 124 Miles. Preſent Lat. 42° 52′ N. Longitude 11° 11′ W. Oporto bears S. 50° 8′ E. Diſtance 53 Leagues.

LOG

OF A

VOYAGE,

FROM THE

LIZARD TO *FUNCHAL*;

IN HIS MAJESTY's SHIP

The SCIPIO, A. B. Commander.

KEPT BY

*G****E D***N.*

LOG BOARD.

H.	K.	F.	Courſes.	Winds.	L W	Remarks, Sunday, March 6th, 1791.
1						
2						
3						
4						
5						
6						At 6, the Lizard bore NE
7	7	—	SW.	WNW.	1	bE 6 Leagues from whence
8	6	8				I take my Departure.
9	6	8				Lizard's { Lat. 49° 57′ N.
10	6	8				{ Long. 5 15 W.
11	5	6				bound to Port Funchal in
12	6	—	——	——	1½	Madeira { Lat. 32 38N.
1	7	—				{ Long. 17 6 W.
2	7	—				Bearing from the Lizard
3	7	—				S 26° 58′ W. 1166 Miles.
4	6	—				
5	7	4	-----	------	---	Unbent the Cables and
6	4	6				ſtowed Anchors.
7	3	—	SW by S.	W by N.	0	Little Wind with ſome
8	3	8				Rain.—A great ſwell from
9	3	8				the NNE. for which I al-
10	3	5				low 10 Miles.
—	3	3	-----	------	---	Got up Top-gallant Maſts
—	—	—				and Yards, and bent Sails.
12	3	6				Variation 2¼ Points Weſt.

Direct Courſe	Diſt.	X. Lat.	Dep.	Latitude.		Mer. Diſt.	Pref. Lon.	Bearings and Diſtance.
				by DR.	by Ob.			
S8°41′ W.	125.2	123.7	18.9	47° 53. N.	47° 53 N.	18′.9 W.	5°44′ W.	Uſhant N. 35° 50′ E. Diſt. 44.41 Miles.

LOG BOARD.

H.	K.	F.	Courſes.	Winds.	LW	Remarks, Monday, March 7th, 1791.
1	7	4	WSW.	NW.	½	Freſh Gales with Rain.
2	7	6				
3	7	5	------	------	---	Set Top-gallant Sails.
4	7	4				
5	6	3	W by S.	NWbN.	¾	
6	6	4	------	------		Spoke with a Ship bound to Quebec.
7	7	5				
8	7	4				
9	7	6				
10	6	8	WSW.		½	In firſt reef both Top-ſails.
11	6	4				
12	6	4				
1	6	4				
2	6	2				
3	6	—				
4	6	—	SSE.		o	Goes large.
5	6	4				
6	6	3	------	------	---	Saw a Ship to the N. with Jury-Maſts up.
7	6	2				
8	7	—				
9	7	2	E by S.		o	Goes large.
10	7	—				
11	7	—				Variation 2¼ Weſt.
12	7	7				

Direct Courſe	Diſt.	X. Lat.	Dep.	Latitude by DR	Latitude by Ob.	Mer Diſt.	Preſ. Lon	Bearings and Diſtance.
S7° 37' W.	101'1	100'1	13'4	46° 13' N.		32'3 W.	6° 3' W.	C. Ortegal S24° 59' W. Diſtance 161 1 Miles.

LOG BOARD.

H.	K.	F.	Courſes.	Winds.	L W	Remarks, Tueſday, March 8th, 1791.
1	6	3	W by S.	NW b N.	1	Wind blowing freſh handed T. G. Sails.
2	6	2				
3	6	2				
4	6	3				
5	6	4	WSW.	NW.	1	
6	6	2	- - - -	- - - -	- - -	Spoke with the Drake Snow bound to London.
7	6	2				
8	6	4				
9	6	7				Do. Weather with Snow.
10	6	4	W by S.	NW b N.	1	
11	6	3				
12	6	8				
1	6	4				
2	6	2				
3	6	6				
4	6	4	- - - -	- - - -	- - -	A Brig to Windward would not bear down, gave her a Shot.
5	6	3	———	———	1½	
6	6	4				
7	6	4				
8	6	—	———	———	2	Wind blowing hard, cloſe reeft both T. S.
9	6	4				
10	6	2				Latitude by Double Altitudes, 44° 6′ N.
11	6	4				
12	6	1	WSW.	NW.	1	Variation 2 Points Weſt.

Direct Courſ.	Diſt.	X. Lat.	Dep.	Latitude by DR.	Latitude by Ob.	Mer. Diſt.	Pr. Lon.	Bearings and Diſtance.
S 39° 37′ W.	151′3	116′.6	96′5	44° 17′ N.	44° 6′ N.	134′1 W.	8°30 W.	Oporto S 29′ E. Diſt. 176 Miles.

LOG BOARD.

H.	K.	F.	Courſes.	Winds.	L W	Remarks, Wedneſday, March 9th, 1791.
1	6	4	WSW.	NW.	3	Hard Wind and a rough
2	6	2				Sea, handed both T. S.
3	6	4				
4	6	—				
5	6	—				
6	6	4				
7	6	6				Wind increaſing.
8	6	—				Handed Fore and Main-ſa
9	6	- -	- - -	- - -	- -	Lay too under the Mizen,
10	Up SSW. off S by E.				6	on the Star-board Tacks.
11	Drift 2 Miles per Hour.					
12						
1						
2	Up E by N. off SE by E.				5	Lay too upon our Lar-board Tacks under the
3						
4	Drift 1 Mile an Hour.					Main-ſail.
5						
6						
7						
8						More moderate and fair,
9	6	2	W by S.	NWbyN.	½	ſet the Top-ſails cloſe reeſt.
10	6	4				
11	7	—				
12	6	4				Variation 2 Points W.

Direct Courſ.	Diſt.	X. Lat.	Dep.	Latitude. by DR.	Latitude. by Ob	Mer. Diſt.	Pref. Lon.	Bearings and Diſtance.
S. 15° 49′ W.	87′.32	84′	23′.8	42° 42′ N.	42° 41′ N.	157′.9 W.	9°.3′ W.	Funchal, S32°18′W.713.4

LOG BOARD.

H.	K.	F.	Courſes.	Winds.	L W	Remarks, Thurſday, March 10th, 1791.
1	6	4	W by N.	N by W.	1½	Moderate Gales and clear
2	6	1				Weather.
3	5	4				
4	4	2				
5	3	3	- - -	-- -	- -	Light Air inclinable to a
6	2	5				Calm.
7	—	—	Calm			
8	—	—	Head W. S. W.			
9	—	—				A Current all Day ſetting
10	—	—				SW by S. 1 Mile an Hour.
11	—	—				
12	—	—	Head S by W.			
1	—	—				
2	—	—				
3	—	—				
4	—	6	W by S.	S by W.	1	Freſh Gales and clear.
5	4	8				
6	4	5				
7	5	3	WSW.	S.	1½	Ditto Weather.
8	4	4				
9	4	3				
10	4	6	SSW.	SE.	0	Cloſe hauled on the Wind.
11	5	7				
12	5	7				Variation 1½ Weſt.

Direct Courſe	Diſt.	X Lat.	Dep	Latitude		Mer. Diſt.	Preſ. Lon.	Bearings and Diſtance.
				by DR.	by Ob			
S45°54 W.	84'.8	59'	60'.9	41°.42' N.		218'8 W.	10°.24' W.	Funchal S30°24 'W. 630.7 Miles.

LOG BOARD.

H.	K.	F.	Courſes.	Winds.	L W	Remarks, Friday, March 11th, 1791.
1	6	—	SbW¾W.	SE¼E.	1½	Freſh Gales and clear.
2	6	2				
3	5	8				
4	5	8	SWbyW	S by E.	2	Out 2d. reef both T. S.
5	5	7				
6	5	6				
7	5	—				
8	5	4	SSW.	SE.	4	Set the Main-ſail.
9	5	8				
10	6	1				
11	5	7				
12	5	5	W.	SE¼E.	0	Ship goes large.
1	5	4				
2	6	—				
3	6	—				
4	6	—	SSW.	SE.	4	
5	6	4				
6	6	2				
7	6	4	- - -	- - - - -	- -	Variat. per Amp. 1¼W.
8	6	—				Latitude by Double Altitudes 40° 39′N. and as
9	6	—	SWbW.	S by E.	2	it is two Days ſince the
10	6	—				laſt Obſ. muſt correct
11	6	—				for two Days.
12	6	—				

Direct Courſ.	Diſt.	X. Lat.	Dep.	Latitude by DR.	Latitude by Ob.	Mer. Diſt.	Pr. Lon.	Bearings and Diſtance.
S 57° 1′ W.	136′.2	74′.1	114′.2	40° 28′ N.	40° 39′ N.	337′.2 W.	13°.2 W.	Funchal, S 22°6′W. Diſt. 519·1 Ms.

LOG BOARD.

H.	K.	F.	Courſes.	Winds.	L W	Remarks, Saturday, March 12th, 1791.
1	6	6	SW.	SSE.	½	Moderate Gales and fair, out firſt reef both T. S. and ſet F. S.
2	7	—				
3	7	4				
4	7	—				
5	7	—				
6	7	1	WSW.	—	0	Ship keeps her Wind.
7	7	2				
8	7	3				
9	7	3				
10	7	2				
11	7	4	SSW.	SE.	1	Set T. G. Sails.
12	7	7				
1	6	8				
2	6	1				
3	6	4	S by W.	SE by E.	1	° ′
4	7	3				90 —
5	7	2				Sun's M. Alt. 48.34
6	7	6				
7	7	4				Zenith Diſt. 41 26 N.
8	7	—	SSW.	—	½	Declination 3 13 S.
9	7	1				
10	7	6				Latitude 38 13 N.
11	7	2				
12	7	—				Variation 1¼ Points W.

Direct Courſ.	Diſt.	X. Lat.	Dep.	Latitude by DR.	Latitude by Ob.	Mer. Diſt.	Pr. Long.	Bearings and Diſtance.
S. 26° 34′ W.	163′7	146′4	73′2	38° 13′ N.	38° 13′ N.	410′ 4 W.	14° 36′ W.	Funchal, S. 20° W. 356½ Miles.

LOG BOARD.

H.	K.	F.	Courſes.	Winds.	LW.	Remarks, Sunday, March 13th, 1791.
1	7	4	W.	S by E.		Moderate Gales.
2	7	6				
3	7	7				
4	8	3				
5	8	1	W by S.	SSE.		Spoke with the Convict Ships bound to Botany-Bay.
6	8	—				
7	8	—				
8	8	—				
9	8	2	- - - -	- - - -		Thomas Jukes, Seaman, died.
10	7	7				
11	7	6	SW.	SE by E.		
12	7	7				
1	7	7				
2	7	5				Ship goes large this 24 Hours.
3	8	—				
4	8	—				
5	7	8				
6	7	7				
7	6	8	W.	S by E.		
8	6	9				Latitude by Obſervation, 36° 48′ N.
9	7	—				
10	7	6				
11	7	6	SWbyW.	S E.		
12	8	3				Variation 1 Point Weſt.

Direct Courſ.	Diſt.	X. Lat.	Dep.	Latitude byDR.	Latitude by Ob.	Mer. Diſt.	Pr. Long.	Bearings and Diſtance.
S. 57° 56′ W.	174′.6	92′.7	148	36° 40′ N.	36° 48′ N.	562′.9 W.	17° 48′ W.	Funchal, S 7° 50′E. Diſt· 252·4′

LOG BOARD.

H.	K.	F.	Courſes.	Winds.	L W	Remarks, Monday, March 14th, 1791.
1	7	4	SSE .	SW.	½	Moderate Gales and fine Weather.
2	7	6				
3	8	—				
4	7	4				
5	7	2				
6	7	5				
7	7	4	S by E½E.	SW½W.	½	
8	7	6	- - - -	- - - -	- -	Committed the Body of the Deceaſed to the Deep.
9	7	—				
10	6	2				
11	6	3				
12	5	—				
1	5	4				
2	5	6	SE by S.	SW by S.	½	
3	5	4				
4	5	3				
5	5	2				
6	5	6				
7	5	4	S by E.	SWbW.	½	Fourteen Sail in Sight.
8	5	4				
9	5	2				
10	5	7	SE½S.	SSW½W	½	
11	5	8				
12	5	4				Variation 1 Point W.

Direct Courſe	Diſt.	X. Lat.	Dep.	Latitude.		Mer. Diſt.	Preſent Long.	Bearings and Diſtance.
				by DR.	by Ob.			
S. 40°. 22'E.	148'2	112'9	9'6	34° 55' N	34° 55' N.	466'9 W.	15° 49' W.	Funchal, S 25°.1' W. Diſt. 151 2 Ms.

L O G   B O A R D.

H.	K.	F.	Courſes.	Winds.	L W	Remarks, Tueſday, March 15th, 1791.
1	7	6	SSW½W	E by S.		Moderate Gales and clear.
2	7	6				
3	7	4				
4	7	5				
5	7	8				
6	7	1				
7	7	—				
8	7	1	SSW.	E by S.		
9	6	8				
10	6	9				
11	7	—				
12	7	—				
1	7	1				
2	6	8				
3	7	3				
4	7	6				
5	7	8				
6	7	5	- - - -	- - - -		Saw Funchal bearing S. 66° 47′ W. Diſtance 28 Miles.
7	7	4				
8	7	5				
9	6	8				
10	6	3	- - - -	- - - -	- -	Came to Anchor off Funchal.
11						
12						Variation ¾ Point W.

Direct Courſe	Diſt	X. Dat.	Dep.	Latitude.		Mer. Diſt.	Preſ. Lon.	Bearings and Diſtance
				by DR.	by Ob			
S. 25°. 1′ W.	151′	137′	63′ 93	32°.38′ N.		530′.8 W.	17°6 W.	Funchal, S ½ Mile.

A Table of the SUN's RIGHT ASCENSION,

DAYS.	Jan.	Feb.	Mar.	Apr.	May.	June.
	S.	S.	S.	N.	N.	N.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	18.48	21. 1	22.50	0.43	2.34	4.37
2	18.53	21. 5	22.53	0.47	2.38	4.41
3	18.57	21. 9	22.57	0.50	2.42	4.45
4	19. 2	21.13	23. 1	0.54	2.46	4.49
5	19. 6	21.17	23. 4	0.58	2.50	4.53
6	19.11	21.21	23. 8	1. 1	2.53	4.58
7	19.15	21.25	23.12	1. 5	2.57	5. 2
8	19.19	21.29	23.16	1. 9	3. 1	5. 6
9	19.24	21.33	23.19	1.12	3. 5	5.10
10	19.28	21.37	23.23	1.16	3. 9	5.14
11	19.32	21.41	23.27	1.20	3.13	5.18
12	19.37	21.45	23.30	1.23	3.17	5.22
13	19.41	21.48	23.34	1.27	3.21	5.26
14	19.45	21.52	23.38	1.31	3.25	5.31
15	19.50	21.56	23.41	1.34	3.29	5.35
16	19.54	22. 0	23.45	1.38	3.33	5.39
17	19.58	22. 4	23.49	1.42	3.37	5.43
18	20. 2	22. 8	23.52	1.45	3.40	5.47
19	20. 7	22.12	23.56	1.49	3.44	5.51
20	20.11	22.16	23.59	1.53	3.48	5.56
21	20.15	22.19	0. 3	1.57	3.52	6. 0
22	20.19	22.23	0. 7	2. 0	3.56	6. 4
23	20.23	22.27	0.10	2. 4	4. 0	6. 8
24	20.28	22.31	0.14	2. 8	4. 4	6.12
25	20.32	22.35	0.18	2.12	4. 9	6.16
26	20.36	22.38	0.21	2.15	4.13	6.21
27	20.40	22.42	0.25	2.19	4.17	6.25
28	20.44	22.46	0.29	2.23	4.21	6.29
29	20.48		0.32	2.27	4.25	6.33
30	20.52		0.36	2.30	4.29	6.37
31	20.57		0.39		4.33	

THIS Table is ſufficiently Exact for finding when any Star comes to the Meridian, in order to obtain the Latitude;

A Table of the SUN's *RIGHT ASCENSION.*

DAYS.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
	N.	N.	N.	S.	S.	S.
	h. m.	h. m.	h. m	h. m.	h. m.	h. m.
1	6.41	8.46	10.42	12.30	14.27	16.31
2	6.45	8.50	10.46	12.34	14.31	16.35
3	6.50	8.54	10.49	12.37	14.34	16.39
4	6.54	8.58	10.53	12.41	14.38	16.44
5	6.58	9. 1	10.57	12.46	14.42	16.48
6	7. 2	9. 5	11. 0	12.48	14.46	16.52
7	7. 6	9.10	11. 4	12.52	14.50	16.57
8	7.10	9.13	11. 7	12.56	14.54	17. 1
9	7.14	9.17	11.11	12.59	14.58	17. 5
10	7.18	9.21	11.15	13. 3	15. 2	17.10
11	7.22	9.24	11.18	13. 7	15. 7	17.14
12	7.26	9.28	11.22	13.10	15.11	17.19
13	7.30	9.32	11.25	13.14	15.15	17.23
14	7.35	9.36	1.29	13.18	15.19	17.27
15	7.39	9.39	11.33	13.22	15.23	17.32
16	7.43	9.43	11.36	13.25	15.27	17.36
17	7.47	9.47	11.40	13.29	15.31	17.41
18	7.51	9.51	11.43	13.33	15.35	17.45
19	7.55	9.54	11.47	13.37	15.39	17.50
20	7.59	9.58	11.51	13.40	15.44	17.54
21	8. 3	10. 2	11.54	13.44	15.48	17.59
22	8. 7	10. 5	11.58	13.48	15.52	18. 3
23	8.11	10. 9	12. 1	13.52	15.56	18. 7
24	8.15	10.13	12. 5	13.56	16. 1	18.12
25	8.19	10.17	12. 9	13.59	16. 5	18.16
26	8.23	10.20	12.12	14. 3	16. 9	18.21
27	8.27	10.24	12.16	14. 7	16.13	18.25
28	8.30	10.28	12.19	14.11	16.18	18.30
29	8.34	10.31	12.23	14.15	16.22	18.34
30	8.38	10.35	12.27	14.19	16.26	18.39
31	8.42	10.38		14.23		18.43

tude; but in Calculations for determining the Longitude, uſe the Ephemeris.

A TABLE *of the*

RIGHT ASCENSIONS *and* DECLINATIONS

Of ſome of the principal FIXED STARS *adapted to the beginning of the Year* 1790, *with their annual Variations.*

NAMES of the STARS. Thoſe marked * are uſed in the Nautical Ephemeris for determining the Longitude.	MAG.	R. Aſcen in Time.	A.V. in R.A.	Declin.	An: Va in Declin·
		H. M. S.	,, +	o , ,	,,
Extremity of the Wing Pegaſus Algenib	2	—. 2.26	3.07	14. 0.55N	+20.05
Bright Star in the Tail of the Whale	2	—.33. 2	3.01	19. 8.32S	—19.86
In the Girdle of Andromeda	2	—.58. 2	3.30	34.30.10N	+19.45
Achermar, in the Spring of Erida	1	1.29.53	2.25	58.18.30S	—18.55
Arietis in the Horn of the Ram *	2	1.55.22	3.33	22.27.45N	+17.60
In the Head of Meduſa, Algol	2	2.54.34	3.85	40. 8. 3N	+14.63
Aldebaran, South Eye of the Bull *	1	4.23.53	3.42	16. 4.24N	+ 8.26
Capella, in the left Shoulder of Auriga	1	5. 1.10	4.37	45.46.—N	+ 5.21
Rigel, the bright Foot of Orion	1	5. 4.26	2.87	8.27.23S	— 4.88
The Weſt Shoulder of Orion	2	5.13.53	3.22	6. 8.43N	+ 4.15
Bright Star in the Dove	2	5.32. 4	2.18	34.11.43S	— 2.48
The Eaſt Shoulder of Orion	1	5.43.48	3.24	7.21.14N	+ 1.51
Canopus, in the Ship Argo	1	6.19.18	1.34	52.35.14S	+ 1.67
Sirius, in the Mouth of the Great Dog	1	6.35.53	2.64	16.26.21S	+ 4.25
In the Tail of the Great Dog	2	7.15.48	2.38	28.54. 9S	+ 6.42
Caſtor, in the Head of the North Twin	1	7.21.10	3.85	32.20.52N	— 6.85
Procyon, the Leſſer Dog	1	7.28.17	3.14	5.45.27N	— 7.45
Pollux, in the Head of the S. Twin *	1	7.32.26	3.68	28.31. 7N	— 7.77
In the Middle of the Ship Argo	2	8.38.53	1.66	53.56.32S	+12.79
Heart of the Female Hydra	2	9.17.16	2.95	7.45.20S	+15.14
Regulus, the Lion's Heart *	1	9.57.10	3.20	2.59.13N	—17.19
S. Star in the Square of the G. Bear	2	10.49. 4	3.74	57.30.15N	—19.0
Northermoſt Star in ditto	1	10.50.39	3.88	62.52.54N	—19.09
The Lion's Tail	2	11.38.21	3.11	15.44.47N	—19.95
In the Foot of the Croſs	1	12.15. 5	3.24	61.56. 7S	+20.—
In the Top of the Croſs	2	12.19.36	3.24	55.56. 1S	+19.98
In the Arm of the Croſs	2	12.35.35	3.41	58.32.20S	+19.81
Virgin's Spike *	1	13.14. 8	3.14	10. 3.34S	+19.04
Laſt Star in the Great Bear's Tail	2	13.39.16	2.41	50.22. 1N	—18.24
Weſtern Foot of the Centeaur	2	13.49.11	4.10	59.20.56S	+17.86
In the Tail of the Dragon	2	13.58.43	1.63	65.23.—N	—17.46
Arcturus, in Bootes	1	14. 6. 5	2.72	20.17.16N	—17.15
Eaſtern Foot of the Centaur	1	14.25.47	4.44	56. 1.56S	+16.16

NAMES of the STARS. Thoſe marked * are uſed in the Nautical Ephemeris for determining the Longitude.	MAG	R. Aſcenſ. in Time. H.M.S.	A.V. in R.A. ,, +	Declin. o , ,,	An. Va. in Declin. ,,
South Scale of Libra	2	14.39.17	3.30	15. 9.26S	+15.46
North Scale of Libra	2	15. 5.44	3.22	8.35.50S	+13.93
Bright Star in the Crown	2	15.25.47	2.53	27.25.54N	—12.56
In the Neck of the Serpent	2	15.33.55	2.93	7. 5.49N	—12.—
Antares, the Scorpion's Heart *	1	16.16.33	3.65	25.56.56S	+ 8.84
In the Head of Hercules	2	17. 5. 5	2.74	14.38.30N	— 4.87
In the Head of Ophiucus	2	17.25.11	2.77	12.43.37N	— 3.12
In the Head of the Dragon	2	17.51.44	1.37	51.31.14N	— 0.78
Lyra, Bright Star in the Harp	1	18·29.49	2.01	38.35.43	+ 2.54
Atair, Bright Star in the Eagle *	1	19.40.32	2.93	8.19.21N	+ 8.44
Eye of the Peacock	2	20. 8.55	4.85	57.23.25S	—10.63
Tail of the Swan	2	20.34.16	2.04	44.32.12N	+12.46
Weſtern Wing of the Crane	2	21.54.55	3.85	47.57.59S	—17.11
Fomalhaut, in the Southern Fiſh *	1	22.46.—	3.32	30.43.49S	—18.98
In the Shoulder of Pegaſus	2	22.53.37	2.88	26.56.44N	+19.18
Markab, in Pegaſus' Wing *	2	22.54.18	2.97	14. 4.44N	+19 20
Head of Andromeda.	2	23.57.33	3.06	27.55.50N	+20.04

If the places of theſe Stars are wanted for any Time after the beginning of the Year 1790, multiply the annual Variation both in Right Aſcenſion and Declination, by the number of Years that have elapſed ſince that Time; to the Product add ſuch a part of the annual Variation as is paſſed of the current Year, and the Sum will be the Variation from the beginning of the Year 1790 to the given Time.

The Variation in Right Aſcenſion muſt always be added to the Right Aſcenſion in the Table, for ſucceeding Years, and the Variation in Declination added or ſubtracted according as the Sign + or — is found againſt it in the Table. but for Years preceding 1790 they muſt be applied to the Right Aſcenſion and Declination ſhewn in the Table with a contrary Sign.

This Table is uſed with that of the Sun's Right Aſcenſion for finding the apparent Time when any Star will be on the Meridian; or, having the Time of the Night to find what Star culminates at that Time; and by this means a Perſon may get acquainted with the Stars without the aſſiſtance of a Globe: but let him remember, that thoſe Stars which have nearly the ſame Right Aſcenſion, differ much in Declination, that he miſtake not one for another which will cauſe a great Error in his Latitude, and likewiſe in his knowledge of the Stars acquired in this manner; but they may be diſtinguiſhed by their Altitudes.

To find the Time when any Star will be upon the Meridian.

RULE.

Seek in the preceding Tables the Right Aſcenſion of the given Star, and that of the Sun on the propoſed Day, and ſubtract the Sun's Right Aſcenſion from the Star's, but if ſubtraction cannot be made, add 24 Hours to the Star's Right Aſcenſion, and then ſubtract, the difference is the Time of the Star's coming to the Meridian in the Afternoon, if the Sun's Right Aſcenſion is leaſt; but before Noon if the Sun's is greateſt.

EXAMPLES.

At what time will the Star Virgin's Spike be on the Meridian of Greenwich, Auguſt 15th, 1790.

	h. m.
Virgin's Spike's Right Aſcenſion	13.14
Sun's Right Aſcenſion	9.39
Star Tranſits the Meridian at	3.35 P. M.

At what time will the Star Aldebaran come to the Meridian of Greenwich, Jan. 1, 1791?

	h. m.
Aldebaran's R. Aſcenſion	4.24
	24.—
	28.24
Sun's R. Aſcenſion	18.48
Aldebaran Culminates	9.36 A. M.

To find what Star will be on the Meridian at any given Time.

RULE.

Add the time from Noon to the Sun's Right Aſcenſion for that time, the Sum rejecting 24 Hours if above, gives the Right Aſcenſion of the Star, which ſeek in the preceding Table, and the Star correſponding thereto will be on or near the Meridian at that time.

EXAMPLES.

What Star will be on the Meridian of Greenwich, about 6 o'Clock P. M. on March 3d, 1790?

	h. m.
Sun's R. Aſcenſion, March 3d at Noon	22.57
6 Hours more	—. 1
Given Time	6.—
Anſwering to Capella	4.58

On April 26, 1791, what Star will be on the Meridian of Greenwich about 2h. 45m. A. M.?

	h.m.
Sun's R. A. April 25 at Noon	2.12
And for 15 Hours more	2
Given Time	14.45
Star in the Head of Hercules	16.59

A
DESCRIPTION AND USE
OF
HADLEY'S OCTANT.

---

1. *The Deſcription.*

THE Arc of this noble and uſeful Inſtrument conſiſts of $\frac{1}{8}$ of the Circumference of a Circle or 45°; but half Degrees by the nature of Reflections anſwer to whole ones; and therefore the Arc is graduated into 90 equal parts, which are ſo many Degrees; and each Degree is divided into three parts of 20 minutes each, which by the help of the Vernier or Nonius on the ſloped ſide of the Index, is again ſubdivided into Minutes of a Degree, by which the poſition of the Index may be known to a ſingle Minute, or even a quarter of a Minute.

The Diviſions on the Arc of ſome of thoſe Quadrants are diagonally divided, but the Vernier's Scale is by far preferable to this Method and much more accurate.

THE Length of the Vernier is equal to 7° which is divided into 20 equal parts, but the ſame number of Degrees on the Limb of the Inſtrument are divided into 21 equal parts, and conſequently the exceſs of one of the Diviſions on the Vernier above one of thoſe on the Arc is 1 Minute, the Difference of the two firſt Diviſions will be 2

Minutes. &c.; conſequently in whatever place the Vernier's Scale ſtands, one of its Diviſions will always ſtand againſt a Diviſion on the Limb.

It has been obſerved, that the Arc or Limb of the Quadrant is divided into 90°, numbered 0, 10, 20, &c. and each Diviſion into 3 parts each 20 Minutes, and is to be Read thus 1°, 1°.20′, 1°.40′, 2°, 2°.20′, &c. obſerving to Read to the Diviſion that the Pointer of the Vernier laſt paſſed over; then the Vernier will give the number of Minutes more to be added to the Diviſion laſt paſſed by the Pointer. Thus, ſuppoſe the Pointer of the Vernier paſſed over 15° and two parts, or 15°.40′, and ſtands ſomewhere between 15°.40′ and 16°, then obſerve what Diviſion or Line on the Vernier, coincides with any Diviſion or Line on the Arc; ſuppoſe 15 on the Vernier, then 15 Minutes added to 15°.40′ gives 15°.55′ for the meaſured Altitude or Angular Diſtance. Again, ſuppoſe the Pointer of the Vernier has paſſed over 35°, and ſtands between the Diviſions of 20 and 40 Minutes, and the 12th Diviſion on the Vernier ſtood againſt a Diviſion on the Arc, then the meaſured Altitude or Angle will be 35°.32′ &c. of others.

The Index is a flat bar moveable on the Centre of the Inſtrument, upon which is fixed a Speculum ſet in braſs, to receive the firſt Image of the Sun or other Object, and reflect it on either of the Horizon-glaſſes.

The Horizon-glaſs uſed in the fore Obſervation, is placed next the Dark-glaſſes, and from it the Eye receives the Image of the Object by a ſecond Reflection; it is ſet in braſs work, that it may at any time be placed perpendicular to the Plane of the Inſtrument, if the ſame by warping or other accident, ſhould be removed from that poſition. It can alſo be turned round, ſo as to make its Surface Parallel with the Surface of the Speculum when the Index ſtands at 0 on the Arc.

The other Horizon-glaſs uſed for the back Obſervation is placed fartheſt from the Centre, and with juſt ſuch braſs work as the former, to ſet it both perpendicular and at right Angles to the Index-glaſs.

The Dark-glaſſes or Screens, are thoſe placed neareſt the Centre of the Inſtrument, the one Lighter and the other Darker, to be uſed ſingly or both together, as the Sun's brightneſs may require.

Each of the Obſervations has a Sight-Vane belonging to it. In that for the fore Obſervation are made two holes to direct the placing of the Eye. The back Obſervation requires but one hole.

There is a great nicety required in the Glaſſes, which ought to be perfectly free from Veins, but above all very Flat, and of an equal Thickneſs, that thereby both Surfaces may be directly parallel to one another, in order to have but one Image by Reflection. The Dark-glaſſes muſt likewiſe be very True; however they do not require the ſame exactneſs as the former which gives the Reflection.

To know whether the Glaſſes be good, take notice of any bright Image, as the Sun, ſeen after the two Reflections, and if the Edges appear perfectly ſharp and diſtinct, and in one, the Glaſſes may be relied on as good; if otherwiſe, not.

To Adjuſt the Quadrant.

To adjuſt the Quadrant, ſignifies to ſet the Index-glaſs perpendicular to the Plane of the Inſtrument, if its Frame ſhould be warped, and then to bring the Horizon-glaſs for the fore Obſervation parallel thereto. The former of which may be done as follows, and the latter accurately by the Sun.

1. *To Adjuſt the Index-glaſs.*

Hold the Plane of the Quadrant in an Horizontal poſition, with the Index-glaſs near the Eye; look right down the Quadrant in ſuch a manner, as to ſee the Arc of the Quadrant direct, and at the ſame time reflected by the Index-glaſs; then if the Arc ſeen direct together with its reflected Image, appear to be in one Line, the Speculum is truly Adjuſted. If not, it muſt be rectified by means of the Screws placed at the back thereof, and it is eaſy to diſcover which way the Inclination is, by preſſing the Index glaſs with your Thumb while you obſerve the Arc.

2. *To Adjuſt the Horizon-glaſs for the fore Obſervation.*

To adjuſt this Glaſs, is, to bring its Axis parallel to the Axis of the Index-glaſs, and this is beſt done by the Sun, thus:

Set the Pointer of the Vernier to O on the Arc, hold the Quadrant horizontally, and meaſure the Diameter of the Sun with the Index firſt on the quadrantal Arc, and then on the extra Arc; if the two Diameters are equal, the Horizon-glaſs is adjuſted; but if they are unequal, turn the Horizon Lever a little one way or the other, till upon Meaſuring them again, they are found equal; or, if the Error be ſmall, and you do not Correct it by the Lever, take $\frac{1}{2}$ the difference between the two Diameters for the Correction of Adjuſtment, to be ſubtracted (from all Obſervations) if the Diameter meaſured with the Index upon the Arc, is greater than that meaſured with the Index off the Arc; but added, if the contrary.

How to Meaſure the Diameter of the Sun.

SET the Pointer of the Vernier to O on the Arc, hold the Quadrant horizontally, and by the Index, bring the reflected Image into external contract with the direct Image and note the Minutes cut by the Vernier; then bring them into contract on the oppoſite ſide of the direct Image, and note the Minutes; then $\frac{1}{2}$ the difference of theſe Diameters will be the Error of Adjuſtment, to be applied as before.

NOTE.

IN Reading off the odd Minutes on the extra Arc, remember to take their Complement to 30, of what the Vernier ſhews.

II.

ON THE

USE of the QUADRANT.

To take the Altitude of the Sun by a fore Obſervation.

THE Quadrant being adjuſted, turn in the Dark-glaſſes, or only one of them if the Sun is not very bright; turn your Face directly to the Sun, hold the Quadrant in a vertical poſition, that is, in a Plane paſſing through the Zenith and Centre of the Object with the Arc downwards, and direct the ſight to that part of the Horizon directly under the Sun, through the tranſparent part of the Horizon-glaſs; at the ſame time move the Index to bring down the red Image of the Sun towards the Horizon, uſing either his upper or lower Edge; then ſwing your Body gently from ſide to ſide, and if the obſerved Edge of the Sun do not cut, but juſt touch the Horizon, the Obſervation is well made; then the Degrees, Minutes, and parts of a Minute, on the Arc, gives the Altitude of that Edge of the Sun which was brought to the Horizon, called the obſerved Altitude.

THE Altitude of the Moon is taken in the ſame manner, only remember to bring that Limb of the Moon into contract with the Horizon, which is round and well defined, whether it be the upper or lower Limb.

To take the Altitude of a Star.

Set the Index at O, and hold the Quadrant in the ſame manner as before, look directly up at the Star and tranſparent part of the Horizon-glaſs; then will the Image of the Star by Reflection be ſeen in the ſilvered part right againſt the Star ſeen through the other part. Move the Index forward, and let the Centre of the Quadrant deſcend as the Image deſcends, to keep it in the ſilvered part till it is brought down in a Line with the Horizon ſeen thro' the tranſparent part, and the Obſervation is made.

How to hold the Quadrant for taking the Angular Diſtance between the Moon and the Sun or a fixed Star.

In taking the Angular Diſtance between any two Objects, the Quadrant muſt always be held in a Plane paſſing through the Eye of the Obſerver, and the two Objects whoſe Diſtance is required.

For Convenience the Quadrant muſt ſometimes be held with its Face uppermoſt, at other times with its Face downwards..

1. When the Quadrant is to be held with its Face uppermoſt, it muſt be ſupported by the Right Hand, and the Index governed by the Left; and the Motion of the Index forwards bring the Right Hand Object, by Reflection, into Contract with the Left Hand one ſeen directly.

2. When the Angle is to be taken with the Inſtrument inverted, or with the Face downwards, then it muſt be held and ſupported by the Left Hand, and the Right re-

ſerved for governing the Index: then the like Motion of the Index will bring the Left Hand Object, by Reflection, into Contract with the Right Hand one ſeen directly.

Therefore in North Latitude, the Quadrant is to be uſed with its Face upwards, when the Object to be ſeen by Reflection is to the Right Hand, or Weſtward of that ſeen directly. But when the Object to be ſeen directly, lies to the Weſtward of that to be ſeen by Reflection, the Quadrant is to be uſed with its face downwards.

How to examine the Angle of the Quadrant.

As a readineſs in the uſe of the Quadrant both ways is only to be obtained by Practice, which the learner may make familiar to himſelf by obſerving the poſition of Land Objects: the Angle of the Quadrant may alſo be verified in this Manner; firſt, by adjuſting the Glaſſes as before directed, and then taking at one Station 8 or 10 Objects comprehending a whole Circle, beginning with any one of them, take the Angular Diſtance of the 1ſt, and 2d, the 2d, and 3d, &c. all round, obſerving that the greateſt Angle do not exceed 90°; then add the Angles together, and if the Sum amounts to 360° exactly, the Angle of the Quadrant and its Graduations may be depended upon as accurate. If the Eye is aſſiſted by a Magnifying Glaſs of 1½ or 2 Inches Focus, the meaſure of an Arc may be read to great accuracy.

To meaſure the Diſtance between the Moon and Sun.

Turn down one of the Screens, and hold the Quadrant ſo, for a fore Obſervation, that its Plane ſhall paſs through the Sun and Moon, look at the Moon directly through the tranſparent part of the Horizon-glaſs, and keeping her there, gently move the Index till the Sun's Image is brought into the ſilvered part of that Glaſs; bring the neareſt Limbs of both Objects into contract, and let the Quadrant librate a little on the Lunar Ray, whereby the Sun will appear to riſe and fall by the ſide of the Moon; and in this motion the neareſt Limbs are to touch one another exactly, by moving the Index; when this is effected, the Obſervation is made; and the Degrees cut by the Vernier will ſhew their Angular Diſtance.

Between the Moon and a Star.

If the Moon is very bright turn down the light Screen, and direct the Plane of the Quadrant to both Objects; look at the Star as in a fore Obſervation through the clear part of the Horizon-glaſs; keep it there, and by moving the Index bring the Moon's Image into the ſilvered part of the ſame Glaſs; let the Quadrant gently librate on the Star's Ray, and the Moon will appear to riſe and fall by the Star; between the librations move the Index, till the Moon's enlightened Limb is exactly touched by the Star, and the Obſervation is made.

⁂ The following Appendix is added to ſave the Reader the trouble of purchaſing an Ephemeris for 1791, for which Year all the Obſervations, in this Work are made; as it contains every particular that has been uſed, or will be wanted for the Solution of the exerciſing Examples.

APPENDIX.

APPENDIX.

Months.	DAYS.	The Sun's Decli.	The Sun's S-dr	The MOON's Paſs the Mer.	The MOON's Declination Noon	The MOON's Declination M.N.	The MOON's Semi-diameter, Noon	The MOON's Semi-diameter, M.N.	The MOON's Horizontal Par. Noon	The MOON's Horizontal Par. M.N.
		° ′ ″	′ ″	H. M.	° ′	° ′	′ ″	′ ″	′ ″	′ ″
January	13	21.26.18 s	—	—	—	—	—	—	—	—
	14	21.15.44 s	—	—	—	—	—	—	—	—
March.	3	—	—	—	—	—	15.27	15.22	56.40	56.25
	24	—	—	—	—	17.59	—	16.18	—	59.51
	25	—	—	—	18.28	s.	16.14	—	59.35	—
May	8	17. 8.49 N	15.53	—	s.	—	—	—	—	—
	9	17.24.54 N	—	—	—	—	—	—	—	—
	13	—	—	—	—	—	—	16.11	—	59.22
	14	—	—	—	—	—	16.18	—	59.49	—
	28	21.30. 3 N	15.49	—	—	—	—	—	—	—
	30	21.48.32 N	—	—	—	—	—	—	—	—
	31	21.57.13 N	—	—	—	—	—	—	—	—
June	1	22. 5.31 N	15.49	—	—	—	—	—	—	—
	2	22.13.26 N	—	—	—	—	—	—	—	—
	10	—	—	—	—	—	—	16. 5	—	59. 2
	11	—	—	—	—	—	16.12	—	59.26	—
July	19	20.50.55 N	—	—	—	—	—	—	—	—
	20	20.39.48 N	—	—	—	—	—	—	—	—
	24	—	—	19.28	—	—	—	—	—	—
	25	—	—	20.14	—	—	—	—	—	—
Auguſt	27	10. 1.32 N	—	—	—	—	—	—	—	—
	28	9.40.21 N	—	—	—	—	—	—	—	—
Sept.	10	—	—	10.45	—	8.5 s.	—	15.44	—	57.44
	11	—	—	11.34	6.8 s.	—	15.40	—	57.29	—
	12	—	15.58	12.22	—	—	—	—	—	—
	13	—	—	13. 9	—	—	—	—	—	—
Oct.	13	—	—	—	—	—	14.57	14.55	54.53	54.43
Nov.	2	—	16.11	—	—	—	16. 1	15.55	58.46	58.24
	4	—	16.12	—	—	—	15.37	15.32	57.19	56.59

Diſtance Moon's Centre from the Sun and Stars.				3 Hours	6 Hours	9 Hours
				° ′ ″	° ′ ″	° ′ ″
Oct.	13	—	Dſt. ☽á ✳	29.17.21	27.46.21	—
Nov.	2	Diſt. oá ☽	—	—	86.14.26	87.49.43
	4	Diſt. oá ☽	—	109.30.24	111. 1. 5	—

How to Conſtruct a Table of Meridianal Parts.

RULE.

The Co-tangent of $\frac{1}{2}$ the Complement of the given Latitude abating Radius, divided by 126331143874, (the natural tangent of 51°.38'.9" being the Angle which the Rhumb-line makes with the Meridian) gives the Meridianal parts anſwering the propoſed Latitude; and in this manner may a Table be conſtructed to every Degree and Minute of the Meridian.

NOTE.

If the Table of Logarithm Tangents conſiſt only of 6 Places of Figures beſides the Index, let the Decimal in the Diviſor be placed thus 126·33, if ſeven Figures, thus 1263·3, &c.

Required the Mer. Parts for Latitude 28°30'?

	° '	
	90 —	
Lat.	28.30	
Co-Lat.	61.30	
	30.45	its Cot. = 10.2255287
		10.

1263·3) 2255287 = 1785·2

the Meridianal parts required.

ON

THE MAGNET.

THE Magnet or Loadſtone, is a rich, heavy, Iron Ore, of a hard Subſtance, duſky grey Colour, with ſome mixture of reddiſh brown, and ſparkling when broke.

THE two ends of a Magnet when it is properly formed, are called its Poles; and when it is placed on a Pivot, in juſt Equilibrium, one end will turn towards the North, and is called its North Pole, and the other end the South Pole.

IF the end of a ſmall Iron Bar be rubbed againſt one of the Poles of a Magnet, it is ſaid to be Touched, and is then called an Artificial Magnet; to make which, conſult Mr. Canton's method in 47th Volume of the Philoſophical Tranſactions. And, if ſuch a Magnet be ſupported on a Pivot, it is called a Magnetic Needle; one end of it turning towards the North, and the other towards the South.

A NEEDLE which is touched will incline towards the Earth, and that is called its Inclination or Dipping, and to prevent this in the common Compaſs, the end which is not touched is made ſomething heavier, by which it is kept in Equilibrio. Under the Equator the Needle has no Inclination, being equally attracted by the two Poles of the Earth.

The Inclination of the Needle is not always the ſame in different Places, nor in the ſame Place at different Times.

The Declination or Variation of the Magnetic Needle is different in different parts of the Earth, and in the ſame part at different Times: For inſtance, the Declination of the Needle at London in the Year 1580, was 11°.15′ Eaſt. in the Year 1657 there was no Declination, that is, the Needle ſtood exactly North and South. At preſent, the Declination is more than 23° Weſtward.

The Inclination of the Needle when it was firſt obſerved in the Year 1576, was found to be 71°.50′; at preſent, it is between 74 and 75°.

ON THE

AZIMUTH COMPASS.

BESIDES the common Sea-Compaſs, there is another called the Azimuth-Compaſs, whoſe uſe is to take the Bearing of any Celeſtial Object when it is in or above the Horizon. This Compaſs differs in no reſpect from the other, only the circumference of the Card or Box is divided into Degrees; and there is fitted to the Box an Index with two Sights, which are upright pieces of Braſs placed diametrically oppoſite, having Slits down their middles through which the Sun or Star is to be viewed at the time of Obſervation.

The Azimuth-Compaſs is particularly uſeful for finding the following things.

I. *The Magnetic Amplitude.*

Move the Box about till the four Cardinal Points of the Card coincide with the four lines in the ſide of the Compaſs Box; keep the Box ſteady, and turn the Index till the Centre of the Sun at its Riſing or Setting, is ſeen through both the Sights; then the Degrees between the Eaſt or Weſt Point of the Compaſs, and that end of the Index pointing to the Sun, will be the Magnetic Amplitude.

II. *The Magnetic Azimuth.*

Set the Box ſo that the four Cardinal Points of the Card, ſtand oppoſite to the four lines in the Compaſs Box; hold the Box in this poſition, and move the Index till (the Sights being directed to the Centre of the Sun) the ſhadow of the String joining the Sights fall directly along the middle line of the Index; then the Degrees in the Arc, intercepted between that end of the Index next the Sun and North or South Point of the Card, according as the Latitude is North or South, will give the Magnetic Azimuth.

If the Sun does not ſhine ſtrong enough to give a diſtinct ſhadow, look through one of the Sights, and move the Index till the String cuts the Sun's Centre, and the intercepted Arc as before, gives the Azimuth. What has been ſaid of the Sun, in like manner is applicable to the Stars.

When there is a rough Sea, and the Ship yaws much, the Obſervation is beſt performed by two Perſons; and if the Card vibrate much, take the middle Degree between the Limits to which the vibration reaches.

When the Magnetic Azimuth of any Object is obſerved its Altitude muſt alſo be taken at the ſame time.

III. *The Leeway.*

Turn the Inſtrument about until you ſee the Wake of the Ship either over the Sights or parallel to them; then the Point of the Card, (which is cut by the Vertical line in the Box) which is neareſt to you, is the true Courſe; the difference between that, and the Courſe given by the Compaſs in the Bittacle is the Leeway required.

A TABLE

Of the SUN's DECLINATION *for the Years* 1789, 1793, 1797, 1801, 1805, 1809, 1813

FIRST AFTER LEAP-YEAR.

DAYS	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	South	South.	South.	North.	North.	North.	North.	North.	North.	South.	South.	South.
	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.
1	22.57	16.53	7.18	4.49	15.17	22.10	23. 6	17.53	8. 3	3.27	14.41	21.57
2	22.52	16.35	6.55	5.12	15.35	22.17	23. 1	17.38	7.42	3.51	15. 0	22. 6
3	22.46	16.18	6.32	5.35	15.53	22.25	22.56	17.22	7.19	4.14	15.19	22.14
4	22.39	15.59	6. 9	5.58	16.10	22.32	22.51	17. 6	6.57	4.37	15.37	22.22
5	22.32	15.41	5.45	6.21	16.27	22.38	22.45	16.50	6.35	5. 0	15.55	22.29
6	22.25	15.23	5.22	6.44	16.44	22.44	22.39	16.33	6.12	5.23	16.13	22.36
7	22.17	15. 4	4.59	7. 6	17. 1	22.50	22.33	16.16	5.50	5.46	16.31	22.43
8	22. 9	14.45	4.35	7.28	17.17	22.55	22.26	15.59	5.27	6. 9	16.48	22.49
9	22. 0	14.25	4.12	7.51	17.33	23. 0	22.19	15.42	5. 5	6.32	17. 5	22.55
10	21.51	14. 6	3.48	8.13	17.48	23. 5	22.11	15.24	4.42	6.55	17.22	23. 0
11	21.42	13.46	3.25	8.35	18. 4	23. 9	22. 3	15. 6	4.19	7.17	17.39	23. 5
12	21.32	13.26	3. 1	8.57	18.19	23.13	21.55	14.48	3.56	7.40	17.55	23.10
13	21.21	13. 6	2.38	9.18	18.33	23.16	21.46	14.30	3.33	8. 3	18.11	23.13
14	21.11	12.45	2.14	9.40	18.48	23.19	21.37	14.11	3.10	8.25	18.26	23.17
15	20.59	12.25	1.50	10. 1	19. 2	23.21	21.27	13.52	2.47	8.47	18.42	23.20
16	20.48	12. 4	1.27	10.22	19.16	23.24	21.17	13.33	2.24	9. 9	18.57	23.22
17	20.36	11.43	1. 3	10.43	19.29	23.25	21. 7	13.14	2. 0	9.31	19.11	23.24
18	20.23	11.21	0.39	11. 4	19.42	23.27	20.57	12.55	1.37	9.53	19.26	23.26
19	20.11	11. 0	0.16	11.25	19.55	23.27	20.46	12.35	1.14	10.15	19.39	23.27
			Nor.									
20	19.58	10.38	0. 8	11.46	20. 8	23.28	20.34	12.15	0.50	10.36	19.53	23.28
21	19.44	10.17	0.32	12. 6	20.20	23.28	20.23	11.55	0.27	10.58	20. 6	23.28
22	19.30	9.55	0.55	12.26	20.32	23.27	20.11	11.35	0. 3	11.19	20.19	23.28
									South			
23	19.16	9.33	1.19	12.46	20.43	23.27	19.58	11.15	0.20	11.40	20.31	23.27
24	19. 1	9.10	1.43	13. 6	20.54	23.25	19.46	10.54	0.44	12. 1	20.44	23.26
25	18.46	8.48	2. 6	13.25	21. 5	23.24	19.33	10.33	1. 7	12.22	20.55	23.24
26	18.31	8.26	2.30	13.44	21.15	23.22	19.19	10.12	1.30	12.42	21. 6	23.22
27	18.16	8. 3	2.53	14. 4	21.25	23.19	19. 6	9.51	1.54	13. 2	21.17	23.19
28	18. 0	7.40	3.17	14.22	21.35	23.17	18.52	9.30	2.17	13.23	21.28	23.16
29	17.43		3.40	14.41	21.44	23.13	18.38	9. 9	2.41	13.42	21.38	23.12
30	17.27		4. 3	14.59	21.53	23.10	18.23	8.47	3. 4	14. 2	21.48	23. 8
31	17.10		4.26		22. 1		18. 8	8.25		14.22		23. 4

A TABLE

Of the SUN's DECLINATION *for the Years*

1790, 1794, 1798, 1802, 1806, 1810, 1814,

SECOND AFTER LEAP-YEAR.

DAYS	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
	South.	South.	South.	North.	North.	North.	North.	North.	North.	South.	South.	South.
	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.
1	22.58	16.57	7.23	4.44	15.13	22. 8	23. 7	17.57	8. 9	3.22	14.36	21.54
2	22.53	16.40	7. 0	5. 7	15.31	22.15	23. 2	17.41	7.47	3.45	14.55	22. 3
3	22.47	16.22	6.37	5.30	15.48	22.23	22.57	17.26	7.25	4. 8	15.14	22.12
4	22.41	16. 4	6.14	5.53	16. 6	22.30	22.52	17.10	7. 3	4.31	15.33	22.20
5	22.34	15.46	5.51	6.15	16.23	22.36	22.47	16.54	6.40	4.55	15.51	22.28
6	22.27	15.27	5.28	6.38	16.40	22.43	22.41	16.37	6.18	5.18	16. 9	22.35
7	22.19	15. 8	5. 5	7. 0	16.56	22.49	22.34	16.20	5.55	5.41	16.27	22.42
8	22.11	14.49	4.41	7.23	17.13	22.54	22.28	16. 3	5.33	6. 4	16.44	22.48
9	22. 2	14.30	4.18	7.45	17.29	22.59	22.20	15.46	5.10	6.27	17. 1	22.54
10	21.53	14.11	3.54	8. 7	17.44	23. 4	22.13	15.28	4.47	6.49	17.18	22.59
11	21.44	13.51	3.31	8.29	18. 0	23. 8	22. 5	15.11	4.24	7.12	17.35	23. 4
12	21.34	13.31	3. 7	8.51	18.15	23.12	21.57	14.53	4. 2	7.35	17.51	23. 8
13	21.24	13.11	2.43	9.13	18.30	23.15	21.48	14.34	3.38	7.57	18. 7	23.12
14	21.13	12.50	2.20	9.35	18.44	23.18	21.39	14.16	3.15	8.20	18.23	23.16
15	21. 2	12.30	1.56	9.56	18.59	23.21	21.30	13.57	2.52	8.42	18.38	23.19
16	20.51	12. 9	1.32	10.17	19.12	23.23	21.20	13.38	2.29	9. 4	18.53	23.22
17	20.39	11.48	1. 9	10.38	19.26	23.25	21.10	13.19	2. 6	9.26	19. 8	23.24
18	20.26	11.27	0.45	10.59	19.39	23.26	20.59	12.59	1.43	9.48	19.22	23.26
19	20.14	11. 5	0.21	11.20	19.52	23.27	20.48	12.40	1.19	10.10	19.36	23.27
			Nort.									
20	20. 1	10.44	0. 2	11.41	20. 5	23.28	20.37	12.20	0.56	10.31	19.50	23.28
21	19.47	10.22	0.26	12. 1	20.17	23.28	20.25	12. 0	0.32	10.53	20. 3	23.28
22	19.34	10. 0	0.50	12.21	20.29	23.28	20.14	11.40	0. 9	11.14	20.16	23.28
									South			
23	19.19	9.38	1.13	12.41	20.40	23.27	20. 1	11.20	0.14	11.35	20.28	23.27
24	19. 5	9.16	1.37	13. 1	20.51	23.26	19.49	10.59	0.38	11.56	20.41	23.26
25	18.50	8.54	2. 0	13.20	21. 2	23.24	19.36	10.38	1. 1	12.17	20.52	23.24
26	18.35	8.31	2.24	13.40	21.13	23.22	19.23	10.17	1.25	12.37	21. 4	23.22
27	18.19	8. 9	2.47	13.59	21.23	23.20	19. 9	9.56	1.48	12.58	21.15	23.20
28	18. 4	7.46	3.11	14.18	21.32	23.17	18.55	9.35	2.11	13.18	21.25	23.17
29	17.47		3.34	14.36	21.42	23.14	18.41	9.14	2.35	13.38	21.35	23.13
30	17.31		3.57	14.55	21.51	23.11	18.27	8.52	2.58	13.57	21.45	23. 9
31	17.14		4.21		21.59		18.12	8.31		14.17		23. 5

A TABLE

Of the SUN's DECLINATION *for the Years* 1789, 1793, 1797, 1801, 1805, 1809, 1813

FIRST AFTER LEAP-YEAR.

DAYS	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	South	South.	South.	North.	North.	North.	North.	North.	North.	South.	South.	South.
	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.
1	22.57	16.53	7.18	4.49	15.17	22.10	23. 6	17.53	8. 3	3.27	14.41	21.57
2	22.52	16.35	6.55	5.12	15.35	22.17	23. 1	17.38	7.42	3.51	15. 0	22. 6
3	22.46	16.18	6.32	5.35	15.53	22.25	22.56	17.22	7.19	4.14	15.19	22.14
4	22.39	15.59	6. 9	5.58	16.10	22.32	22.51	17. 6	6.57	4.37	15.37	22.22
5	22.32	15.41	5.45	6.21	16.27	22.38	22.45	16.50	6.35	5. 0	15.55	22.29
6	22.25	15.23	5.22	6.44	16.44	22.44	22.39	16.33	6.12	5.23	16.13	22.36
7	22.17	15. 4	4.59	7. 6	17. 1	22.50	22.33	16.16	5.50	5.46	16.31	22.43
8	22. 9	14.45	4.35	7.28	17.17	22.55	22.26	15.59	5.27	6. 9	16.48	22.49
9	22. 0	14.25	4.12	7.51	17.33	23. 0	22.19	15.42	5. 5	6.32	17. 5	22.55
10	21.51	14. 6	3.48	8.13	17.48	23. 5	22.11	15.24	4.42	6.55	17.22	23. 0
11	21.42	13.46	3.25	8.35	18. 4	23. 9	22. 3	15. 6	4.19	7.17	17.39	23. 5
12	21.32	13.26	3. 1	8.57	18.19	23.13	21.55	14.48	3.56	7.40	17.55	23.10
13	21.21	13. 6	2.38	9.18	18.33	23.16	21.46	14.30	3.33	8. 3	18.11	23.13
14	21.11	12.45	2.14	9.40	18.48	23.19	21.37	14.11	3.10	8.25	18.26	23.17
15	20.59	12.25	1.50	10. 1	19. 2	23.21	21.27	13.52	2.47	8.47	18.42	23.20
16	20.48	12. 4	1.27	10.22	19.16	23.24	21.17	13.33	2.24	9. 9	18.57	23.22
17	20.36	11.43	1. 3	10.43	19.29	23.25	21. 7	13.14	2. 0	9.31	19.11	23.24
18	20.23	11.21	0.39	11. 4	19.42	23.27	20.57	12.55	1.37	9.53	19.26	23.26
19	20.11	11. 0	0.16	11.25	19.55	23.27	20.46	12.35	1.14	10.15	19.39	23.27
			Nor.									
20	19.58	10.38	0. 8	11.46	20. 8	23.28	20.34	12.15	0.50	10.36	19.53	23.28
21	19.44	10.17	0.32	12. 6	20.20	23.28	20.23	11.55	0.27	10.58	20. 6	23.28
22	19.30	9.55	0.55	12.26	20.32	23.27	20.11	11.35	0. 3	11.19	20.19	23.28
									South			
23	19.16	9.33	1.19	12.46	20.43	23.27	19.58	11.15	0.20	11.40	20.31	23.27
24	19. 1	9.10	1.43	13. 6	20.54	23.25	19.46	10.54	0.44	12. 1	20.44	23.26
25	18.46	8.48	2. 6	13.25	21. 5	23.24	19.33	10.33	1. 7	12.22	20.55	23.24
26	18.31	8.26	2.30	13.44	21.15	23.22	19.19	10.12	1.30	12.42	21. 6	23.22
27	18.16	8. 3	2.53	14. 4	21.25	23.19	19. 6	9.51	1.54	13. 2	21.17	23.19
28	18. 0	7.40	3.17	14.22	21.35	23.17	18.52	9.30	2.17	13.23	21.28	23.16
29	17.43		3.40	14.41	21.44	23.13	18.38	9. 9	2.41	13.42	21.38	23.12
30	17.27		4. 3	14.59	21.53	23.10	18.23	8.47	3. 4	14. 2	21.48	23. 8
31	17.10		4.26		22. 1		18. 8	8.25		14.22		23. 4

A TABLE

Of the SUN's DECLINATION *for the Years* 1790, 1794, 1798, 1802, 1806, 1810, 1814,

SECOND AFTER LEAP-YEAR.

DAYS	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
	South.	South.	South.	North.	North.	North.	North.	North.	North.	South.	South.	South.
	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.
1	22.58	16.57	7.23	4.44	15.13	22. 8	23. 7	17.57	8. 9	3.22	14.36	21.54
2	22.53	16.40	7. 0	5. 7	15.31	22.15	23. 2	17.41	7.47	3.45	14.55	22. 3
3	22.47	16.22	6.37	5.30	15.48	22.23	22.57	17.26	7.25	4. 8	15.14	22.12
4	22.41	16. 4	6.14	5.53	16. 6	22.30	22.52	17.10	7. 3	4.31	15.33	22.20
5	22.34	15.46	5.51	6.15	16.23	22.36	22.47	16.54	6.40	4.55	15.51	22.28
6	22.27	15.27	5.28	6.38	16.40	22.43	22.41	16.37	6.18	5.18	16. 9	22.35
7	22.19	15. 8	5. 5	7. 0	16.56	22.49	22.34	16.20	5.55	5.41	16.27	22.42
8	22.11	14.49	4.41	7.23	17.13	22.54	22.28	16. 3	5.33	6. 4	16.44	22.48
9	22. 2	14.30	4.18	7.45	17.29	22.59	22.20	15.46	5.10	6.27	17. 1	22.54
10	21.53	14.11	3.54	8. 7	17.44	23. 4	22.13	15.28	4.47	6.49	17.18	22.59
11	21.44	13.51	3.31	8.29	18. 0	23. 8	22. 5	15.11	4.24	7.12	17.35	23. 4
12	21.34	13.31	3. 7	8.51	18.15	23.12	21.57	14.53	4. 2	7.35	17.51	23. 8
13	21.24	13.11	2.43	9.13	18.30	23.15	21.48	14.34	3.38	7.57	18. 7	23.12
14	21.13	12.50	2.20	9.35	18.44	23.18	21.39	14.16	3.15	8.20	18.23	23.16
15	21. 2	12.30	1.56	9.56	18.59	23.21	21.30	13.57	2.52	8.42	18.38	23.19
16	20.51	12. 9	1.32	10.17	19.12	23.23	21.20	13.38	2.29	9. 4	18.53	23.22
17	20.39	11.48	1. 9	10.38	19.26	23.25	21.10	13.19	2. 6	9.26	19. 8	23.24
18	20.26	11.27	0.45	10.59	19.39	23.26	20.59	12.59	1.43	9.48	19.22	23.26
19	20.14	11. 5	0.21	11.20	19.52	23.27	20.48	12.40	1.19	10.10	19.36	23.27
			Nort.									
20	20. 1	10.44	0. 2	11.41	20. 5	23.28	20.37	12.20	0.56	10.31	19.50	23.28
21	19.47	10.22	0.26	12. 1	20.17	23.28	20.25	12. 0	0.32	10.53	20. 3	23.28
22	19.34	10. 0	0.50	12.21	20.29	23.28	20.14	11.40	0. 9	11.14	20.16	23.28
									South			
23	19.19	9.38	1.13	12.41	20.40	23.27	20. 1	11.20	0.14	11.35	20.28	23.27
24	19. 5	9.16	1.37	13. 1	20.51	23.26	19.49	10.59	0.38	11.56	20.41	23.26
25	18.50	8.54	2. 0	13.20	21. 2	23.24	19.36	10.38	1. 1	12.17	20.52	23.24
26	18.35	8.31	2.24	13.40	21.13	23.22	19.23	10.17	1.25	12.37	21. 4	23.22
27	18.19	8. 9	2.47	13.59	21.23	23.20	19. 9	9.56	1.48	12.58	21.15	23.20
28	18. 4	7.46	3.11	14.18	21.32	23.17	18.55	9.35	2.11	13.18	21.25	23.17
29	17.47		3.34	14.36	21.42	23.14	18.41	9.14	2.35	13.38	21.35	23.13
30	17.31		3.57	14.55	21.51	23.11	18.27	8.52	2.58	13.57	21.45	23. 9
31	17.14		4.21		21.59		18.12	8.31		14.17		23. 5

A TABLE

Of the SUN's DECLINATION *for the Years* 1791, 1795, 1799, 1803, 1807, 1811, 1815,

THIRD AFTER LEAP-YEAR.

DAYS.	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.
	South.	South.	South.	North.	North.	North	North.	North.	North.	South.	South.	South.
	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.
1	23. 0	17. 1	7.29	4.38	15. 8	22. 6	23. 8	18. 0	8.14	3.16	14.31	21.52
2	22.54	16.44	7. 6	5. 1	15.26	22.13	23. 3	17.45	7.52	3.39	14.51	22. 1
3	22.49	16.26	6.43	5.24	15.44	22.21	22.59	17.30	7.30	4. 3	15. 9	22.10
4	22.42	16. 8	6.20	5.47	16. 2	22.28	22.53	17.14	7. 8	4.26	15.28	22.18
5	22.36	15.50	5.57	6.10	16.19	22.35	22.48	16.57	6.46	4.49	15.46	22.26
6	22.29	15.32	5.34	6.3	16.36	22.41	22.42	16.41	6.23	5.12	16. 4	22.33
7	22.21	15.13	5.10	6.55	16.52	22.47	22.36	16.24	6. 1	5.35	16.22	22.40
8	22.13	14.54	4.47	7.17	17. 9	22.53	22.29	16. 7	5.38	5.58	16.40	22.46
9	22. 4	14.35	4.23	7.40	17.25	22.58	22.22	15.50	5.16	6.21	16.57	22.52
10	21.56	14.15	4. 0	8. 2	17.41	23. 3	22.15	15.33	4.53	6.44	17.14	22.58
11	21.46	13.56	3.36	8.24	17.56	23. 7	22. 7	15.15	4.30	7. 6	17.31	23. 3
12	21.36	13.36	3.13	8.46	18.11	23.11	21.59	14.57	4. 7	7.29	17.47	23. 7
13	21.26	13.16	2.49	9. 8	18.26	23.14	21.50	14.39	3.44	7.52	18. 3	23.12
14	21.16	12.55	2.26	9.29	18.41	23.18	21.41	14.20	3.21	8.14	18.19	23.15
15	21. 5	12.35	2. 2	9.51	18.55	23.20	21.32	14. 2	2.58	8.36	18.34	23.18
16	20.53	12.14	1.38	10.12	19. 9	23.23	21.22	13.43	2.35	8.58	18.49	23.21
17	20.42	11.53	1.15	10.33	19.23	23.24	21.12	13.24	2.12	9.20	19. 4	23.23
18	20.29	11.32	0.51	10.54	19.36	23.26	21. 2	13. 4	1.48	9.42	19.19	23.25
19	20.17	11.10	0.27	11.15	19.49	23.27	20.51	12.45	1.25	10. 4	19.33	23.27
20	20. 4	10.49	0. 4	11.36	20. 2	23.28	20.40	12.25	1. 2	10.26	19.46	23.27
			Nor.									
21	19.51	10.27	0.20	11.56	20.14	23.28	20.28	12. 5	0.38	10.47	20. 0	23.28
22	19.37	10. 6	0.44	12.16	20.26	23.28	20.17	11.45	0.15	11. 9	20.13	23.28
									South			
23	19.23	9.44	1. 7	12.36	20.37	23.27	20. 4	11.25	0. 9	11.30	20.25	23.27
24	19. 8	9.21	1.31	12.56	20.49	23.26	19.52	11. 4	0.32	11.51	20.38	23.26
25	18.54	8.59	1.55	13.16	21. 0	23.25	19.39	10.43	0.55	12.11	20.49	23.25
26	18.39	8.37	2.18	13.35	21.10	23.23	19.26	10.23	1.19	12.32	21. 1	23.23
27	18.23	8.14	2.42	13.54	21.20	23.21	19.12	10. 2	1.42	12.53	21.12	23.20
28	18. 7	7.52	3. 5	14.13	21.30	23.18	18.59	9.40	2. 6	13.13	21.23	23.17
29	17.51		3.28	14.32	21.39	23.15	18.45	9.19	2.29	13.33	21.33	23.14
30	17.35		3.52	14.50	21.49	23.11	18.30	8.58	2.53	13.53	21.43	23.10
31	17.18		4.15		21.57		18.15	8.36		14.12		23. 6

A TABLE

Of the SUN's DECLINATION *for the Years* 1792, 1796, 1800, 1804, 1808, 1812, 1816,

BEING LEAP-YEAR.

DAYS.	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.
	South.	South.	South.	North.	North.	North.	North.	North.	North.	South.	South.	South.
	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.	D.M.
1	23. 1	17. 5	7.11	4.56	15.22	22.12	23. 4	17.49	7.58	3.33	14.46	21.59
2	22.56	16.48	6.48	5.19	15.40	22.19	23. 0	17.33	7.36	3.57	15. 5	22. 8
3	22.50	16.30	6.25	5.41	15.57	22.26	22.55	17.18	7.14	4.20	15.23	22.16
4	22.44	16.13	6. 2	6. 4	16.15	22.33	22.49	17. 1	6.51	4.43	15.42	22.24
5	22.37	15.55	5.39	6.27	16.32	22.40	22.44	16.45	6.29	5. 6	16. 0	22.31
6	22.30	15.36	5.16	6.50	16.48	22.46	22.37	16.28	6. 7	5.29	16.18	22.38
7	22.23	15.18	4.52	7.12	17. 5	22.51	22.31	16.12	5.44	5.52	16.35	22.45
8	22.15	14.59	4.29	7.34	17.21	22.57	22.24	15.54	5.21	6.15	16.53	22.51
9	22. 7	14.39	4. 6	7.57	17.37	23. 1	22.17	15.37	4.59	6.38	17.10	22.56
10	21.58	14.20	3.42	8.19	17.52	23. 6	22. 9	15.19	4.36	7. 1	17.27	23. 2
11	21.49	14. 0	3.19	8.41	18. 8	23.10	22. 1	15. 1	4.13	7.23	17.43	23. 6
12	21.39	13.41	2.55	9. 2	18.23	23.14	21.52	14.43	3.50	7.46	17.59	23.11
13	21.29	13.21	2.31	9.24	18.37	23.17	21.43	14.25	3.27	8. 8	18.15	23.14
14	21.18	13. 0	2. 8	9.46	18.52	23.20	21.34	14. 6	3. 4	8.31	18.31	23.18
15	21. 7	12.40	1.44	10. 7	19. 6	23.22	21.25	13.47	2.41	8.53	18.46	23.21
16	20.56	12.19	1.20	10.28	19.19	23.24	21.15	13.28	2.17	9.15	19. 1	23.23
17	20.45	11.58	0.57	10.49	19.33	23.26	21. 4	13. 9	1.54	9.37	19.15	23.25
18	20.32	11.37	0.33	11.10	19.46	23.27	20.54	12.49	1.31	9.59	19.29	23.26
19	20.20	11.16	0. 9	11.31	19.59	23.27	20.42	12.30	1. 7	10.21	19.43	23.27
			Nort.									
20	20. 7	10.54	0.14	11.51	20.11	23.28	20.31	12.10	0.44	10.42	19.57	23.28
21	19.54	10.32	0.38	12.11	20.23	23.28	20.19	11.50	0.21	11. 3	20.10	23.28
									South			
22	19.40	10.11	1. 2	12.31	20.35	23.27	20. 7	11.30	0. 3	11.25	20.22	23.27
23	19.26	9.49	1.25	12.51	20.46	23.26	19.55	11. 9	0.26	11.46	20.35	23.26
24	19.12	9.27	1.49	13.11	20.57	23.25	19.42	10.48	0.50	12. 6	20.47	23.25
25	18.57	9. 4	2.12	13.30	21. 8	23.23	19.29	10.28	1.13	12.27	20.58	23.23
26	18.42	8.42	2.36	13.50	21.18	23.21	19.16	10. 7	1.37	12.48	21. 9	23.21
27	18.27	8.20	2.59	14. 9	21.28	23.19	19. 2	9.45	2. 0	13. 8	21.20	23.18
28	18.11	7.57	3.23	14.27	21.37	23.16	18.48	9.24	2.23	13.28	21.30	23.15
29	17.55	7.34	3.46	14.46	21.46	23.12	18.34	9. 3	2.47	13.48	21.40	23.11
30	17.39		4. 9	15. 4	21.55	23. 8	18.19	8.41	3.10	14. 7	21.50	23. 7
31	17.22		4.33		22. 4		18. 4	8.19		14.27		23. 2

A TABLE

OF THE

SEMIDIAMETER OF THE SUN.

Month.	Days.	Semi-dr.	Month.	Days.	Semi-dr.
		' "			' "
JAN.	1	16.19	JULY.	1	15.47
	7	16.19		7	15.47
	13	16.19		13	15.47
	19	16.18		19	15.48
	25	16.18		25	15.48
FEB.	1	16.16	AUG.	1	15.49
	7	16.16		7	15.50
	13	16.14		13	15.51
	19	16.13		19	15.52
	25	16.12		25	15.53
MARCH.	1	16.11	SEP.	1	15.55
	7	16. 9		7	15.56
	13	16. 8		13	15.58
	19	16. 6		19	15.59
	25	16. 4		25	16. 1
APRIL.	1	16. 2	OCT.	1	16. 3
	7	16. 1		7	16. 4
	13	15.59		13	16. 6
	19	15.58		19	16. 8
	25	15.56		25	16. 9
MAY.	1	15.55	NOV.	1	16.11
	7	15.53		7	16.12
	13	15.52		13	16.14
	19	15.51		19	16.15
	25	15.50		25	16.16
JUNE.	1	15.49	DEC.	1	16.17
	7	15.48		7	16.18
	13	15.48		13	16.18
	19	15.47		19	16.19
	25	15.47		25	16.19

THE above Table will be found ſufficiently accurate, for correcting the obſerved Altitude of the Sun to find the Latitude; and indeed may ſerve in all Caſes for determining the Longitude.

A TABLE

OF THE

LATITUDES OF PLACES,

WITH THEIR

LONGITUDES;

FROM THE

MERIDIAN of the ROYAL OBSERVATORY,

AT

GREENWICH.

NAMES OF PLACES.	Cont.	Sea or Country.	Latitude.	Longitude.
		A.	° ′ ″	° ′ ″
Abbeville	Europe	France	50 7 1 N	1 49 45 E
Abo	Europe	Finland	60 27 10 N	22 13 30 E
Achem	Aſia	Sumatra	5 22 0 N	95 34 0 E
Adventure, Bay	Aſia	N. Holland	43 23 0 S	147 30 0 E
Adventure, Iſle	Aſia	Pacific Ocean	17 5 15 S	144 17 45 W
Agde	Europe	France	43 18 57 N	3 28 11 E
Agen	Europe	France	44 12 7 N	0 35 49 E
St. Agnes, Lights	Europe	Scillies	49 56 0 N	6 46 0 W
Agra	Aſia	India	26 43 0 N	76 44 0 E
Aire	Europe	France	43 31 35 N	0 16 26 W
Aix	Europe	France	43 31 35 N	5 26 15 E
Alby	Europe	France	43 55 44 N	2 8 45 E
Aleppo	Aſia	Turkey	35 45 23 N	37 20 0 E
Alexandretta	Aſia	Syria	36 35 10 N	36 20 0 E
Alexandria	Africa	Egypt	31 11 20 N	30 16 30 E
Algiers	Africa	Algiers	36 49 30 N	2 12 45 E
Amboiſe	Europe	France	47 24 54 N	0 59 7 E
Ambrym, Iſle	Aſia	Pacific Ocean	16 9 30 S	168 12 30 E
Amiens	Europe	France	49 53 38 N	2 17 56 E
Amſterdam	Europe	Holland	52 22 45 N	4 45 30 E
Amſterdam, Iſle	Aſia	Pacific Ocean	21 9 0 S	174 46 0 W
Ancona	Europe	Italy	43 37 54 N	13 30 30 E
Angers	Europe	France	47 28 8 N	0 33 52 W
Angouléme	Europe	France	45 39 3 N	0 8 45 E
Angra	Europe	Tercera	38 39 0 N	27 12 15 W
Annanocka	Aſia	Pacific Ocean	20 16 30 S	174 30 30 W
St. Anthony's, Cape	America	Staten Land	54 46 45 S	
Antibes	Europe	France	43 34 50 N	7 8 30 E
Antigua, St. John's	America	Carib. Sea	17 4 30 N	62 9 0 W
Antwerp	Europe	Flanders	51 13 15 N	4 22 45 E
Anvers	Europe	Netherlands	51 13 15 N	4 24 15 E
Apa, Iſle	Aſia	Pacific Ocean	16 46 15 S	168 27 30 E
Aracta	Aſia	Turkey	36 1 0 N	38 50 0 E
Archangel	Europe	Ruſſia	64 34 0 N	38 55 0 E
Arica	America	Peru	18 26 38 S	71 11 0 W
Arles	Europe	France	43 40 33 N	4 38 0 E
Arras	Europe	France	50 17 30 N	2 46 12 E
Aſcenſion, Iſle	Africa	S. Atl. Ocean	7 56 30 S	14 21 15 W
Athens	Europe	Turkey	38 5 0 N	23 52 30 E
Auch	Europe	France	43 38 46 N	0 34 36 E
St. Auguſtin	Africa	Madagaſcar	23 35 29 S	43 8 0 E
Aurillac	Europe	France	44 55 10 N	2 27 0 W
Aurora, Iſle	Aſia	Pacific Ocean	15 8 0 S	168 17 0 E
Autum	Europe	France	46 56 46 N	4 18 8 E
Auxerre	Europe	France	47 47 54 N	3 34 20 E
Auxonne	Europe	France	47 11 24 N	5 23 35 E
Avignon	Europe	France	43 57 25 N	4 48 33 E
Avranches	Europe	France	48 41 18 N	1 22 38 W

Names of Places.	Cont.	Sea or Country.	Latitude.	Longitude.
		B.		
			° ′ ″	° ′ ″
Babylon, Ancient	Aſia	Meſopotamia	33 0 0 N	42 46 30 E
Bagdad	Aſia	Meſopotamia	33 20 0 N	43 46 30 E
Balaſore	Aſia	India	21 20 0 N	86 0 0 E
Balabea, Iſle	Aſia	N. Caledonia	20 7 0 S	164 22 0 E
Banguey, Peak	Aſia	Malacca	7 18 0 N	117 17 30 E
Barbas, Cape	Africa	Sanhaga	22 15 30 N	16 40 0 W
Barbuda, Iſle	America	Atlant. Ocean	17 49 45 N	61 50 0 W
Barcelona	Europe	Spain	41 26 0 N	2 13 0 E
Barnevelt's Iſle	America	Terra d. Fuego	55 49 0 S	66 58 0 W
St. Bartholomew, Iſle	Aſia	N. Hebrides	15 42 0 S	167 17 30 E
Baſil	Europe	Switzerland	47 35 0 N	7 29 30 E
Baſſa Terre	America	Guadaloupe	15 59 30 N	61 59 15 W
Batavia	Aſia	Java	6 10 0 S	106 51 15 E
Bath	Europe	England	51 22 30 N	2 21 30 W
Bayeux	Europe	France	49 16 30 N	0 42 51 W
Bayonne	Europe	France	43 29 21 N	1 30 6 W
Beachy Head	Europe	England	50 44 30 N	0 19 40 E
Bear, Iſle	America	Hudſon's Bay	54 34 0 N	79 56 0 W
Beauvois	Europe	France	49 26 2 N	2 4 42 E
Belle, Iſle	Europe	France	47 17 30 N	3 6 30 W
Bembridge Point	Europe	Iſle of Wight	50 40 15 N	1 4 45 W
Bencoolen	Aſia	Sumatra	3 49 3 S	102 0 0 E
Berlin	Europe	Germany	52 32 30 N	13 26 15 E
Bermudas, Iſle	America	Atlant. Ocean	32 35 0 N	63 28 0 W
Beſanſon	Europe	France	47 13 45 N	6 2 40 E
Beſiers	Europe	France	43 20 41 N	3 12 35 E
Blanco, Cape	Africa	Negroland	20 55 30 N	17 10 0 W
Blanco, Cape	America	Patagonia	47 20 0 S	64 42 0 W
Blois	Europe	France	47 35 19 N	1 19 50 E
Bojador, Cape	Africa	Negroland	26 12 30 N	14 27 0 W
Bolabola, Iſle	Aſia	Pacific Ocean	16 32 30 S	151 52 0 W
Bologna	Europe	Italy	44 29 36 N	11 21 15 E
Bolſchereſkoi	Aſia	Siberia	52 54 30 N	156 37 30 E
Bombay	Aſia	India	18 56 40 N	72 38 0 E
Bonaviſta, Iſle	Africa	Atlant Ocean	16 6 0 N	22 47 15 W
Boſton	America	New England	42 25 0 N	70 37 15 W
Botany, Iſland	Aſia	N. Caledonia	22 26 40 S	167 16 45 E
Bologne	Europe	France	50 43 31 N	1 36 44 E
Bourbon, Iſle	Africa	Indian Ocean	20 51 43 S	55 30 0 E
Bourdeaux	Europe	France	44 50 18 N	0 34 49 W
Bourges	Europe	France	47 4 58 N	2 23 26 E
Breſlaw	Europe	Sileſia	51 3 0 N	17 8 45 E
Breſt	Europe	France	48 22 55 N	4 30 50 W
Bridge-Town	America	Barbadoes	13 5 0 N	59 41 15 W
St. Brieux	Europe	France	48 31 21 N	2 43 17 W
Briſtol, Cape	America	Sandw. Land	59 2 30 S	26 51 0 W
Bruſſels	Europe	Brabant	50 51 0 N	4 21 45 E
Buenos Ayres	America	Braſil	34 35 26 S	58 31 15 W

Names of Places.	Cont.	Sea or Country	Latitude.	Longitude.
			° ' ''	° ' ''
Bukaroſt	Europe	Walachia	44 26 45 N	26 8 0 E
Buller, Cape	America	S. Georgia	53 58 30 S	37 40 0 W
Burgeo, Iſles	America	Newfoundland	47 36 20 N	57 36 30 W
Burlings	Europe	Portugal	39 20 0 N	9 36 45 W
C.				
Cabello Port	America	Terra Firma	10 30 50 N	67 32 0 W
Cadiz	Europe	Spain	36 31 7 N	6 11 50 W
Caen	Europe	France	49 11 10 N	0 21 47 W
Cahors	Europe	France	44 26 4 N	1 26 51 E
Cairo	Africa	Egypt	30 2 44 N	31 27 15 E
Calais	Europe	France	50 57 31 N	1 50 36 E
Callas	America	Peru	12 1 53 S	76 58 0 W
Calcutta, F. William	Aſia	India	22 34 45 N	88 29 30 E
Calmar	Europe	Sweden	56 40 30 N	16 21 45 E
Cambray	Europe	France	50 10 32 N	3 13 41 E
Cambridge	Europe	England	52 12 36 N	0 4 15 E
Cambridge	America	N. England	42 25 0 N	71 10 0 W
Canary, Iſle, NE Point	Africa	Canaries	28 13 0 N	15 38 45 W
Candia, Iſle	Europe	Medit. Sea	35 18 35 N	25 18 0 E
Candlemas, Iſles	America	Sandw. Land	57 10 0 S	27 13 0 W
Canſo, Port	America	Nova-Scotia	45 20 7 N	60 55 0 W
Canton	Aſia	China	23 7 50 N	113 2 15 E
Carleſcroon	Europe	Sweden	56 20 0 N	15 26 15 E
Carthagena	Europe	Spain	37 37 0 N	1 8 30 W
Carthagena	America	Terra Firma	10 26 35 N	75 26 45 W
Caſan	Aſia	Siberia	55 43 58 N	49 8 15 E
Caſſel	Europe	Germany	51 19 4 N	9 29 0 E
Caſtres	Europe	France	43 37 10 N	2 14 45 E
St. Catherine's, Iſle	America	Atlant. Ocean	27 35 0 S	49 17 0 W
Cavan	Europe	Ireland	54 51 41 N	7 23 0 W
Cayenne	America	Iſle Cayenne	4 56 0 N	52 15 0 W
Cette	Europe	France	43 23 51 N	3 42 7 E
Challon	Europe	France	46 46 50 N	4 51 25 E
Chálons	Europe	France	48 57 12 N	4 22 12 E
Chandernagor	Aſia	India	22 51 26 N	88 29 15 E
Q. Charlotte Sound	Aſia	N. Zealand	41 5 58 S	174 13 32 E
Q Charlotte Foreland	Aſia	N. Caledonia	22 15 0 S	167 12 45 E
Q. Charlotte's Cape	America	S. Georgia	54 32 0 S	36 11 30 W
Charlton-Iſle	America	Hudſon's Bay	52 3 0 N	79 5 0 W
Chartres	Europe	France	48 26 49 N	1 28 55 E
Cherbourg	Europe	France	49 38 26 N	1 38 11 W
Chriſtmas Sound	America	Ter del Fuego	55 21 57 S	70 2 50 W
St Chriſtopher's Iſle	America	Caribean Sea	17 15 0 N	62 43 0 W
Churchill River	America	Hudſon's Bay	58 47 32 N	94 7 30 W
Civita Vecchia	Europe	Italy	42 5 24 N	11 46 15 E
Cape Clear	Europe	Ireland	51 18 0 N	9 9 30 W

Names of Places.	Cont.	Sea or Country.	Latitude.	Longitude.
			° ' ''	° ' ''
Clerke's Iſles	America	Atlant. Ocean	55 5 30 s	34 42 0 w
Clermont	Europe	France	45 46 45 N	3 5 7 E
Cape Colenet	Aſia	N. Caledonia	20 30 0 s	164 56 0 E
Colmar	Europe	France	48 4 44 N	7 22 11 E
Cologne	Europe	Germany	50 55 0 N	7 5 0 E
Cape Comerin	Aſia	India	7 56 0 N	78 5 0 E
Compeigne	Europe	France	49 24 59 N	2 49 41 E
Conception	America	Chili	36 42 53 s	72 40 0 w
Cooper's Iſle	America	Atlant. Ocean	54 57 0 s	36 4 20 w
Conſtantinople	Europe	Turkey	41 1 24 N	28 53 49 E
Copenhagen	Europe	Denmark	55 40 45 N	12 35 15 E
Coquimbo	America	Chili	29 54 26 s	71 15 45 w
Cork	Europe	Ireland	51 53 54 N	8 28 15 w
Cape Coronation	Aſia	N. Caledonia	22 5 0 s	167 8 0 E
Carvo	Europe	Azores	39 42 0 N	31 6 0 w
Coutances	Europe	France	49 2 50 N	1 27 25 w
Cowes	Europe	Iſle of Wight	50 46 20 N	1 19 45 w
Cracow	Europe	Poland	50 10 0 N	19 50 0 E
Cremſmunſter	Europe	Germany	48 3 29 N	14 7 0 E
Croiſic	Europe	France	47 17 40 N	2 31 42 w
Cumberland, Cape	Aſia	N. Hebrides	14 39 30 s	166 47 0 E
Cummin, Iſle	Aſia	Pacific Ocean	31 40 0 N	121 4 0 E

D.

Names of Places.	Cont.	Sea or Country.	Latitude.	Longitude.
Dantzic	Europe	Poland	54 22 0 N	18 33 37 E
Daſſen Iſland	Africa	Caffres	33 25 0 s	18 2 0 E
Dax	Europe	France	43 42 23 N	1 3 55 w
St. Dennis	Africa	I. Bourbon	20 51 43 s	55 30 0 E
Diego, Cape	America	Ter. del Fuego	54 33 0 s	65 14 0 w
Dieppe	Europe	France	49 55 17 N	1 4 12 E
Dijon	Europe	France	47 19 22 N	5 2 23 E
Dillengen	Europe	Germany	48 30 0 N	10 14 30 E
Diſappointment, Cape	America	S. Georgia	54 58 0 s	36 15 0 w
Diſſeada, Cape	America	Ter. del Fuego	53 4 15 s	74 18 0 w
Dol	Europe	France	48 33 9 N	1 46 12 w
Dominique, Iſle	America	Windw. Iſles	15 18 23 N	61 27 55 w
Douay	Europe	Flanders	50 22 12 N	3 4 47 E
Dover	Europe	England	51 7 47 N	1 18 30 E
Dreux	Europe	France	48 44 17 N	1 21 24 E
Dronthiem	Europe	Norway	63 26 10 N	11 3 45 E
Dublin	Europe	Ireland	53 21 11 N	6 6 30 w
Dungeneſs	Europe	England	50 52 20 N	0 59 6 E
Dunkirk	Europe	France	51 2 4 N	2 22 23 E
Duſkey Bay	Aſia	N. Zealand	45 47 27 s	166 18 9 E
Dunnoſe	Europe	England	50 33 30 N	1 16 20 w

Names of Places.	Cont.	Sea or Country.	Latitude.	Longitude.
		E.		
			° ′ ″	° ′ ″
Eaoowe, Iſle	Aſia	Pacific Ocean	21 24 0 s	174 30 0 w
Eaſter, Iſland	America	Pacific Ocean	27 6 30 s	109 46 45 w
Edinburgh	Europe	Scotland	55 57 57 N	3 12 15 w
Edyſtone	Europe	Eng. Channel	50 8 0 N	4 24 0 w
Embrun	Europe	France	44 34 0 N	6 29 0 E
Enatum, Iſle	Aſia	Pacific Ocean	20 10 0 s	170 4 0 E
Engliſh-Road	Aſia	Eaoowe	21 20 30 s	174 34 0 w
Erramangu, Iſle	Aſia	Pacific Ocean	18 46 30 s	169 18 30 E
Erzerum	Aſia	Armenia	39 56 35 N	48 35 45 E
Euſtachia, Town	America	Caribean Sea	17 29 0 N	63 10 0 w
Evout's Iſles	America	Ter. del Fuego	55 34 30 s	66 59 0 w
Evereux	Europe	France	49 1 24 N	1 8 39 E
Exeter	Europe	England	50 44 0 N	3 34 30 w
		F.		
Falmouth	Europe	England	50 8 0 N	5 2 30 w
Falſe, Cape	Africa	Caffres	34 16 0 s	18 44 0 E
Falſe, Bay	Africa	Caffres	34 10 0 s	18 33 0 E
Farewell, Cape	America	Greenland	59 38 0 N	42 42 0 w
Farewell, Cape	Aſia	N. Zealand	40 37 0 s	172 41 30 E
Faval-Town	Europe	Azores	38 32 20 N	28 41 5 w
Ferdinand Noronha	America	Brazil	3 56 20 s	32 38 0 w
Ferrara	Europe	Italy	44 54 0 N	11 36 15 E
Ferro Iſle, Town	Africa	Canaries	27 47 20 N	17 45 50 w
Finiſterre, Cape	Europe	Spain	42 51 52 N	9 17 10 w
Florence	Europe	Italy	43 46 30 N	11 2 0 E
Flores	Europe	Azores	39 34 0 N	31 0 0 w
St. Flour	Europe	France	45 1 55 N	3 5 30 E
Fortaventure, W. Pt.	Africa	Canaries	28 4 0 N	14 31 30 w
Foul, Point	Africa	Madagaſcar	17 40 14 s	49 53 0 E
France, Iſle of	Africa	Indian Ocean	20 9 45 s	57 28 0 E
Francfort on the Main	Europe	Germany	49 55 0 N	8 35 0 E
Francois, Cape	America	Hiſpaniola	19 46 30 N	72 18 0 w
Old Cape Francois	America	Hiſpaniola	19 40 30 N	70 2 0 w
Frawenburgh	Europe	Pruſſia	54 22 15 N	20 7 30 E
Frejus	Europe	France	43 26 3 N	6 44 45 E
Freckel, Cape	Europe	France	48 41 3 N	6 0 0 w
Frieſland's Peak	America	Sandw. Land.	59 2 0 s	26 55 30 w
Fronſac, Strait	America	Nova Scotia	45 36 57 N	61 19 30 w
Fuego, Iſle	Africa	Cape Verd	14 56 45 N	24 28 0 w
Funchal	Africa	Madeira	32 37 40 N	17 6 15 w
Furneaux, Iſland	Aſia	Pacific Ocean	17 11 0 s	143 6 40 w

G.

Names of Places.	Cont.	Sea or Country	Latitude.	Longitude.
			° ' "	° ' "
Gap	Europe	France	44 33 50 N	6 4 57 E
Gabey	Aſia	N. Guinea	0 6 0 S	126 23 45 E
Genes	Europe	Italy	44 25 09 N	8 35 45 E
Geneva	Europe	Savoy	46 12 0 N	6 0 0 E
Genoa	Europe	Italy	44 25 0 N	8 35 45 E
St. George, Iſle	Europe	Azores	38 39 0 N	28 0 0 W
St. George, Town	America	Bermudas	32 45 0 N	63 35 0 W
St. George, Fort	Aſia	India	13 4 54 N	80 28 45 E
St George, Cape	Aſia	New Britain	4 53 30 S	153 8 45 E
George, Cape	America	S. Georgia	54 17 0 S	36 32 30 W
Ghent	Europe	Flanders	51 3 0 N	3 43 45 E
Gibralter	Europe	Spain	36 5 30 N	5 22 0 W
Gilbert's Iſle	America	Ter. del Fuego	55 13 0 S	71 6 45 W
Glaſgow	Europe	Scotland	55 51 32 N	4 15 0 W
Goa	Aſia	India	15 31 0 N	73 45 0 E
Goat, Iſle	Aſia	Indian Ocean	13 55 0 N	120 2 0 E
Gomera, Iſle	Africa	Canaries	28 5 40 N	17 8 0 W
Good-Hope, Cape	Africa	Caffres	34 29 0 S	18 23 15 E
Good-Hope, Town	Africa	Caffres	33 55 42 S	18 23 15 E
Goree, Iſle	Africa	Atlant. Ocean	14 40 10 N	17 25 0 W
Gottenburgh	Europe	Sweden	57 42 0 N	11 38 45 E
GottengenObſervatory	Europe	Germany	51 31 54 N	9 53 0 E
Granville	Europe	France	48 50 11 N	1 37 7 W
Graſſe	Europe	France	43 39 25 N	6 56 0 E
Gratioſa	Europe	Azores	39 2 0 N	27 58 0 W
Gratz	Europe	Germany	47 4 18 N	15 24 45 E
Gravelines	Europe	Flanders	50 59 4 N	2 7 32 E
Greenwich Obſervat.	Europe	England	51 28 40 N	0 0 0
Grenoble	Europe	France	45 11 49 N	5 43 40 E
Gryphiſwald	Europe	Germany	54 4 25 N	13 38 30 E
Guadaloupe	America	Carib. Sea	15 59 30 N	61 59 15 W
Guiaquil	America	Peru	2 11 21 S	81 11 30 W
Gurief	Aſia	Siberia	47 7 8 N	51 57 0 E

H.

Names of Places.	Cont.	Sea or Country	Latitude.	Longitude.
Hague	Europe	Netherlands	52 4 10 N	4 17 30 E
Hamburgh	Europe	Netherlands	53 34 8 N	9 50 0 E
Hang-lip Cape	Africa	Caffres	34 16 0 S	18 44 0 E
Harborough Mark	Europe	England	52 28 30 N	0 57 25 W
Haſtings	Europe	England	50 52 10 N	0 41 10 E
Havannah	America	Cuba	23 11 52 N	82 18 30 W
Havre-de-Grace	Europe	France	49 29 9 N	0 5 57 E
Heeſe, La	Europe	Netherlands	51 23 2 N	4 45 30 E
St. Helena, Ja. Town	Africa	S. Atl. Ocean	15 55 0 S	5 49 0 W

Names of Places.	Cont.	Sea or Country	Latitude.	Longitude.
			° ' "	° ' "
Henlopen, Cape	America	Delaware	38 56 8 N	75 4 17 W
Hernoſand	Europe	Sweden	62 38 0 N	17 53 0 E
Hervey's Iſle	Aſia	Pacific Ocean	19 17 0 S	158 48 0 W
Hinchinbrook, Iſle	Aſia	Pacific Ocean	17 25 0 S	168 38 0 E
Hoai-Nghan	Aſia	China	33 34 40 N	118 49 30 E
Hogue, Cape la	Europe	France	49 44 40 N	1 56 50 W
Hood's, Iſle	Aſia	Pacific Ocean	9 26 0 S	138 52 0 W
Hoogſtraeten	Europe	Netherlands	51 24 44 N	4 47 0 E
Horn, Cape	America	Ter. del Fuego	55 58 30 S	67 26 0 W
Hout, Bay	Africa	Caffres	34 3 0 S	18 19 0 E
Howe's Iſle	Aſia	Pacific Ocean	16 46 30 S	154 6 40 W
Huahine, Iſle	Aſia	Pacific Ocean	16 44 0 S	151 6 0 W
		I. J.		
Jakutſkoi	Aſia	Siberia	62 1 30 N	129 47 45 E
Janeiro Rio	America	Brazil	22 54 10 S	42 43 45 W
Jaſſy	Europe	Moldavia	47 8 30 N	27 29 45 E
Java Head	Aſia	Java	6 49 0 S	106 50 0 E
Jeruſalem	Aſia	Paleſtine	31 55 0 N	35 20 0 E
St. Ildephonſo's Iſles	America	Ter. del Fuego	55 51 0 S	69 28 0 W
Immer, Iſle	Aſia	Pacific Ocean	19 16 0 S	169 46 0 E
Ingolſtadt	Europe	Germany	48 45 45 N	11 22 30 E
St. John's	America	Antigua	17 4 30 N	62 9 0 W
St. John's	America	Newfoundland	47 32 0 N	52 26 0 W
St. Joſeph's	America	California	23 3 42 N	109 42 30 W
Irraname, Iſle	Aſia	Pacific Ocean	19 31 0 S	170 21 0 E
Iſlamabad	Aſia	India	22 20 0 N	91 45 0 E
Iſle of Pines	Aſia	Pacific Ocean	22 38 0 S	167 38 0 E
Iſpahan	Aſia	Perſia	32 25 0 N	52 50 0 E
St. Juan, Cape	America	Staten Land	54 47 10 S	63 47 0 W
Judda	Aſia	Arabia	21 29 0 N	39 22 0 E
St. Julian, Port	America	Patagonia	49 10 0 S	68 44 0 W
Juthia	Aſia	India	14 18 0 N	100 50 0 E
		K.		
Kedgeree	Aſia	India	21 48 0 N	88 50 15 E
Kiow	Europe	Ukraine	50 30 0 N	31 7 30 E
Kolu	Europe	Lapland	68 52 30 N	33 8 0 E
		L.		
Ladrone, Grand	Aſia	Pacific Ocean	22 2 0 N	113 56 0 E
Laguna	Africa	Teneriffe	28 28 57 N	16 18 15 W
Lancarota, E. Point	Africa	Canaries	29 14 0 N	13 26 0 W
Landau	Europe	France	49 11 38 N	8 7 30 E
Landſcroon	Europe	Sweden	55 52 0 N	12 46 45 E

Names of Places.	Cont.	Sea or Country	Latitude.	Longitude.
			° ′ ″	° ′ ″
Langres	Europe	France	47 52 17 N	5 19 23 E
Lauſanne	Europe	Switzerland	46 31 5 N	6 45 15 E
Lectoure	Europe	France	43 56 2 N	0 36 53 E
Leeds	Europe	England	53 48 0 N	1 34 15 W
Leiceſter	Europe	England	52 38 0 N	1 8 30 W
Leipſic	Europe	Saxony	51 19 14 N	12 20 0 E
Leper's Iſland	Aſia	Pacific Ocean	15 23 30 S	167 58 15 E
Leſkeard	Europe	England	50 26 55 N	4 41 45 W
Leſparre	Europe	France	45 18 33 N	0 57 3 W
Leyden	Europe	Holland	52 10 0 N	4 27 30 E
Liege	Europe	Netherlands	50 37 30 N	5 35 0 E
Lima	America	Peru	12 1 15 S	76 49 30 W
Limoges	Europe	France	45 49 53 N	1 15 9 E
Lintz	Europe	Germany	48 16 0 N	13 57 30 E
Liſeux	Europe	France	49 11 0 N	0 15 0 E
Liſle	Europe	Flanders	50 37 50 N	3 4 16 E
Liſbon	Europe	Portugal	38 42 25 N	9 9 59 W
Lion's Bank	Europe	Atlant. Ocean	56 40 0 N	17 45 0 W
Liſburne, Cape	Aſia	N. Hebrides	15 40 45 S	166 57 0 E
Lizard	Europe	England	49 57 30 N	5 15 0 W
Lombes	Europe	France	43 28 30 N	0 55 9 E
London, St. Pauls	Europe	England	51 31 0 N	0 5 37 W
Lorenzo, Cape	America	Peru	1 2 0 S	80 17 0 W
St. Louis, Port	America	Hiſpaniola	18 18 50 N	73 16 0 W
St. Louis, Port	Africa	Mauritius	20 9 45 S	57 28 0 E
Louiſbourgh	America	Cape Breton	45 53 39 N	59 53 45 W
Louveau	Aſia	India	12 42 30 N	101 1 30 E
Louvain	Europe	Netherlands	50 53 3 N	4 44 15 E
St. Lucia, Iſle	America	Antilles	13 24 30 N	60 51 30 W
Lunden	Europe	Sweden	55 41 36 N	13 21 15 E
Lunneville	Europe	France	48 35 33 N	6 30 6 E
Luſen	Europe	France	46 27 14 N	1 10 34 W
Luxembourgh	Europe	Netherlands	49 37 6 N	6 11 45 E
Lyons	Europe	France	45 45 51 N	4 49 43 E
M.				
Macao	Aſia	China	22 12 44 N	113 46 15 E
Macaſſar	Aſia	Celebes	5 9 0 S	119 48 45 E
Madeira, Funchal	Africa	Atlant. Ocean	32 37 40 N	17 6 15 W
Madraſs	Aſia	India	13 4 54 N	80 28 45 E
Madre de Dois, Port	Aſia	Marqueſas	9 55 30 S	139 8 40 W
Madrid	Europe	Spain	40 25 0 N	3 25 45 W
Magdelena, Iſle	Aſia	Pacific Ocean	10 25 30 S	138 49 0 W
Mahon, Port	Europe	Minorca	39 50 46 N	3 48 30 E
Majorca, Iſle	Europe	Medit. Sea	39 35 0 N	2 29 45 E
Malacca	Aſia	India	2 12 6 N	102 5 0 E
Malines	Europe	Netherlands	51 1 50 N	4 28 45 E

Names of Places.	Cont.	Sea or Country.	Latitude.	Longtiude.
			° ′ ″	° ′ ″
Mallicola, Iſle	Aſia	Pacific Ocean	16 15 30 S	167 39 15 E
St. Maloes	Europe	France	48 38 59 N	2 2 22 W
Malta, Iſle	Africa	Medit. Sea	35 54 0 N	14 28 30 E
Manilla	Aſia	Philippines	14 36 8 N	120 53 24 E
Marigalante, Iſle	America	Atlant. Ocean	15 55 15 N	61 11 0 W
Marſeilles	Europe	France	43 17 45 N	5 22 8 E
St. Martha	America	Terra Firma	11 26 40 N	74 4 30 W
St. Martin's Iſle	America	Caribean Sea	18 4 20 N	63 2 0 W
Martinico, Iſle	America	Atlant. Ocean	14 44 0 N	61 21 16 W
St. Mary's, Iſle	Europe	Scilly Iſles	49 57 30 N	6 43 0 W
St. Mary's, Town	Europe	Azores	36 56 40 N	25 9 15 W
Maſkelyne's Iſles	Aſia	Pacific Ocean	16 32 0 S	167 59 15 E
St. Matthew, Lights	Europe	France	48 19 52 N	4 47 25 W
Mauritius	Africa	Indian Ocean	20 9 45 S	57 29 15 E
Mauru, Iſle	Aſia	Pacific Ocean	16 25 40 S	152 32 40 W
Mayance	Europe	Germany	49 54 0 N	8 20 0 E
Mayne, John's Iſle	Europe	North. Ocean	71 10 0 N	9 49 30 W
Mayo, Iſle	Africa	Cape Verd	15 10 0 N	23 5 0 W
Meux	Europe	France	48 57 37 N	2 52 35 E
Mende	Europe	France	44 30 47 N	3 29 32 E
Mergui	Aſia	Siam	12 12 0 N	98 8 45 E
Metz	Europe	France	49 7 5	6 11 0 E
Mew Stone	Aſia	New Holland	43 48 0 S	146 27 0 E
Mexico	America	Mexico	19 54 0 N	100 5 45 W
Mezieres	Europe	France	49 45 47 N	4 43 16 E
Miatea, Iſle	Aſia	Pacific Ocean	17 52 0 S	148 6 0 W
St. Michael's Iſle	Europe	Azores	37 47 0 N	25 42 0 W
Middleburgh, Iſle	Aſia	Pacific Ocean	21 20 30 S	174 34 0 W
Milan	Europe	Italy	45 28 10 N	9 10 0 E
Milo, Iſle	Europe	Medit. Sea	36 41 0 N	25 0 0 E
Modena	Europe	Italy	44 34 0 N	11 12 30 E
Mons	Europe	Netherlands	50 27 10 N	3 57 15 E
Montagu, Cape	America	Sandw. Land	58 33 0 S	26 46 0 W
Montagu, Iſle	Aſia	Pacific Ocean	17 26 0 S	168 31 30 E
Montmirail	Europe	France	48 52 8 N	3 32 16 E
Montpellier	Europe	France	43 36 33 N	3 52 44 E
Montſerrat, Iſle	America	Caribean Sea	16 47 30 N	62 17 0 W
Monument, The	Aſia	Pacific Ocean	17 14 15 S	168 38 15 E
Moſcow	Europe	Moſcovy	55 45 20 N	37 45 45 E
Moulins	Europe	France	46 34 4 N	3 19 59 E
Munich	Europe	Bavaria	48 9 55 N	11 30 0 E
Muſketto, Cove	America	Greenland	64 55 13 N	52 56 45 W
Muſkwell Hill	Europe	England	51 35 32 N	0 7 20 W

Names of Places.	Cont.	Sea or Country.	Latitude	Longitude.
N.				
			° ′ ″	° ′ ″
Namur	Europe	Netherlands	50 28 32 N	4 44 45 E
Nancy	Europe	France	48 41 28 N	6 1 33 E
Nangaſachi	Aſia	Japan	32 32 0 N	128 46 15 E
Nantes	Europe	France	47 13 7 N	1 33 48 W
Naples	Europe	Italy	40 50 45 N	14 13 45 E
Narbonne	Europe	France	43 11 13 N	3 0 8 E
Nevers	Europe	France	46 59 13 N	3 9 25 E
New Year's Harbour	America	Staten Land	54 48 55 S	64 11 0 W
Nice	Europe	France	43 41 54 N	7 17 15 E
St. Nicholas Mole	America	Hiſpaniola	19 49 20 N	73 29 45 W
Nieuport	Europe	Flanders	51 7 41 N	2 45 0 E
Ningpo	Aſia	China	29 57 45 N	120 18 0 E
Niſmes	Europe	France	43 50 35 N	4 21 11 E
Noir, Cape	America	Ter. del Fuego	54 32 30 S	73 3 15 W
Norfolk Iſland	Aſia	Pacific Ocean	29 1 45 S	168 10 0 E
Noriton	America	Penſylvania	40 9 56 N	75 23 30 W
North Cape	Europe	Lapland	71 10 0 N	25 57 0 E
Cape North	America	S. Georgia	54 4 45 N	33 15 0 W
Noyon	Europe	France	49 34 37 N	3 0 43 E
Nuremberg	Europe	Germany	49 27 10 N	11 7 0 E
O.				
Oaitapeha	Aſia	Otaheite	17 45 45 S	149 14 20 W
Ochoz	Aſia	Tartary	59 20 10 N	143 12 30 E
Ohamaneno Harbour	Aſia	Ulliateah	16 45 30 S	151 38 5 W
Ohevahoa, Iſle	Aſia	Pacific Ocean	9 40 40 S	139 1 40 W
Ohitahoo, Iſle	Aſia	Pacific Ocean	9 55 30 S	139 6 0 W
Oleron, Iſle	Europe	France	46 2 50 N	1 25 13 W
Olinde	America	Brazil	8 13 0 S	35 5 30 W
St. Omer's	Europe	Flanders	50 44 46 N	2 14 57 E
Onateayo, Iſle	Aſia	Pacifie Ocean	9 58 0 S	138 51 0 W
Oporto	Europe	Portugal	41 10 0 N	8 27 0 W
Orenburg	Aſia	Tartary	51 46 0 N	55 9 30 E
Orleans	Europe	France	47 54 4 N	1 54 22 E
Orleans, New	America	Louiſiana	29 57 45 N	89 58 45 W
Orotava	Africa	Teneriffe	28 23 27 N	16 24 11 W
Orſk	Aſia	Tartary	51 12 30 N	58 32 30 E
Ortagal, Cape	Europe	Spain	43 46 30 N	7 39 0 W
Oſnaburg, Iſle	Aſia	Pacific Ocean	17 52 20 S	148 6 0 W
Oſtend	Europe	Netherlands	51 13 55 N	2 55 45 E
Owharre Bay	Aſia	Huahine	16 44 0 S	151 8 15 W
Oxford, Obſervatory	Europe	England	51 45 38 N	1 15 30 W

P.

Names of Places.	Cont.	Sea or Country.	Latitude.	Longitude.
			° ′ ″	° ′ ″
Padua	Europe	Italy	45 22 26 N	11 55 30 E
Payta	America	Peru	5 12 0 S	
Pallifer's Iſles	Aſia	Pacific Ocean	15 38 15 S	146 30 15 W
Palliſer, Cape	Aſia	N. Zealand	41 38 0 S	175 23 12 E
Palma, Iſle	Africa	Canaries	28 36 45 N	17 50 0 W
Palmerſton's Iſles	Aſia	Pacific Ocean	18 0 0 S	162 57 0 W
Panama	America	Mexico	8 47 48 N	80 21 0 W
Paoom, Iſle	Aſia	Pacific Ocean	16 30 0 S	168 28 45 E
Paris, Obſervatory	Europe	France	48 50 14 N	2 20 0 E
Patrixfiord	Europe	Iceland	65 35 45 N	24 10 0 W
Pau	Europe	France	43 15 0 N	0 9 0 W
St. Paul's Iſle	Africa	Indian Ocean	37 51 0 S	77 48 0 E
St. Paul de Léon	Europe	France	48 40 55 N	4 0 21 W
Pekin	Aſia	China	39 54 30 N	116 24 15 E
Perigeux	Europe	France	45 11 10 N	0 43 1 E
Perinaldi	Europe	Italy	43 53 20 N	7 40 0 E
Perpignan	Europe	France	42 41 55 N	2 54 5 E
St. Peter's Fort	America	Martinico	14 44 0 N	61 21 16 W
St. Peter's Iſle	America	Atlant. Ocean	46 46 30 N	56 17 0 W
Peterſburgh	Europe	Ruſſia	59 56 0 N	30 19 15 E
Petit Goave	America	Hiſpaniola	18 27 0 N	72 52 30 W
Petropawloſkoi	Aſia	Kamchatka	53 1 20 N	158 35 0 E
Philadelphia	America	Penſylvania	39 56 55 N	75 13 30 W
St. Phillip's Fort	Europe	Minorca	39 50 46 N	3 48 30 E
Pickerſgill's Iſles	America	Atlant. Ocean	54 42 30 S	36 58 0 W
Pickerſgill's Harbour	Aſia	N. Zealand	45 47 27 S	166 18 9 E
Pico	Europe	Azores	38 28 40 N	28 26 0 W
Pines, Iſle	Aſia	N. Caledonia	22 38 0 S	167 38 0 E
Piſa	Europe	Italy	43 43 7 N	10 12 0 E
Plymouth	Europe	England	50 22 24 N	4 15 38 W
Poitiers	Europe	France	46 35 0 N	0 20 5 E
Pollingen	Europe	Germany	47 48 8 N	10 43 45 E
Pondicherry	Aſia	India	11 41 55 N	79 52 45 E
Ponoi	Europe	Lapland	67 6 30 N	36 23 15 E
Pentoiſe	Europe	France	49 3 2 N	2 5 37 E
Porto Bello	America	Mexico	9 33 5 N	79 50 0 W
Port Jackſon	Aſia	New S. Wales	33 52 30 S	151 19 30 E
Porto Sancto, Iſle	Africa	Madeira	32 58 15 N	16 25 15 W
Port Royal	America	Jamaica	18 0 0 N	76 45 30 W
Port Royal	America	Martinico	14 35 55 N	61 - 9 0 W
Portſmouth Town	Europe	England	50 47 5 N	1 6 15 W
——— ——— Academy	Europe	England	50 48 3 N	1 6 18 W
Portland, Iſle	Europe	North Sea	63 22 0 N	18 54 0 W
Portland, Iſle	Aſia	Pacific Ocean	39 25 0 S	178 12 0 E
Port Paix	America	Hiſpaniola	19 58 0 N	73 2 0 W
Port Praya	Africa	St. Jago	14 53 53 N	23 23 22 W

Names of Places.	Cont.	Sea or Country.	Latitude.	Longitude.
			° ′ ″	° ′ ″
Prague	Europe	Bohemia	50 4 30 N	14 45 0 E
Prince of Wales' Fort	America	New Wales	58 47 32 N	94 7 30 W
Providence	America	N. England	41 50 40 N	71 26 0 W
Pudyoua	Aſia	N. Caledonia	20 18 0 S	164 41 14 E
Pulo Condor, Iſle	Aſia	Indian Ocean	8 40 0 N	107 20 0 E
Pulo Timon, Iſle	Aſia	Gulph Siam	3 0 0 N	104 25 0 E
Pyleſtaart's Iſle	Aſia	Pacific Ocean	22 23 0 S	175 41 30 W
Q.				
Quebec	America	Canada	46 55 0 N	69 53 0 W
Quimper	Europe	France	47 58 24 N	4 7 25 W
St. Quinton	Europe	France	49 50 51 N	3 17 23 E
Quiros, Cape	Aſia	N. Hebrides	14 56 8 S	167 20 0 E
Quito	America	Peru	0 13 17 S	77 55 0 W
R.				
Rakah, Ancient	Aſia	Meſopotamia	36 1 0 N	38 50 0 E
Ramhead	Europe	England	50 18 40 N	4 20 15 W
Re, Iſle	Europe	France	46 14 48 N	1 34 28 W
Recif	America	Brazil	8 10 0 S	35 35 0 W
Reikianeſs, Cape	Europe	Iceland	63 55 0 N	22 47 30 W
Rennes	Europe	France	48 6 45 N	1 41 53 W
Reſolution, Bay	Aſia	Ohitahoo	9 55 30 S	139 8 40 W
Reſolution, Iſle	Aſia	Pacific Ocean	17 23 30 S	141 45 0 W
Reſolution, Port	Aſia	Tanna	19 32 25 S	169 41 5 E
Rheims	Europe	France	49 14 36 N	4 2 53 E
Rhodes	Europe	France	44 21 0 N	2 34 20 E
Rimini	Europe	Italy	44 3 43 N	12 34 15 E
Rio Janerio	America	Braſil	22 54 10 S	42 43 45 W
Rochelle	Europe	France	46 9 21 N	1 9 55 W
Rochford	Europe	France	46 2 34 N	0 58 34 W
Rock of Liſbon	Europe	Portugal	38 45 30 N	9 35 30 W
Rodrigues, Iſle	Africa	Indian Ocean	19 40 40 S	63 10 0 E
Rome, St. Peter's	Europe	Italy	41 53 54 N	12 29 15 E
Rotterdam	Europe	Holland	51 56 0 N	4 28 15 E
Rotterdam, Iſle	Aſia	Pacific Ocean	20 16 30 S	174 30 30 W
Rouen	Europe	France	49 26 43 E	1 5 20 E
S.				
Saba, Iſle	America	Caribean Sea	17 39 30 N	63 17 15 W
Sable, Cape	America	Nova Scotia	43 23 45 N	65 39 15 W
Sagan	Europe	Sileſia	51 42 12 N	15 22 15 E
Saintes	Europe	France	45 44 43 N	0 38 54 W
Saiute-Croix	Europe	France	48 0 35 N	7 23 55 E
Sall, Iſle	Africa	Atlant. Ocean	16 38 15 N	22 56 15 W

Names of Places.	Cont.	Sea or Country.	Latitude.	Longitude.
			° ′ ″	° ′ ″
Salonique	Europe	Turkey	40 41 10 N	23 8 0
Salvages, Iſles	Africa	Atlant. Ocean	30 0 0 N	15 54 0 W
Samana	America	Hiſpaniola	19 15 0 N	69 16 30 W
Sancta-Cruz	Africa	Teneriffe	28 27 30 N	16 16 15 W
Sandwich Bay	America	S. Georgia	54 42 0 S	36 12 0 W
Sandwich, Cape	Aſia	Mallicola	16 28 0 S	167 59 0 E
Sandwich Harbour	Aſia	Mallicola	16 25 20 S	167 53 0 E
Sandwich Iſle	Aſia	Pacific Ocean	17 41 0 S	168 33 0 E
Saunders' Cape	America	Sandw. Land	54 6 30 S	36 57 30 W
Saunders' Iſle	America	S. Georgia	58 0 0 S	26 58 0 W
Savage, Iſle	Aſia	Pacific Ocean	19 2 15 S	169 30 30 W
Scheweringen	Europe	Germany	49 23 4 N	8 40 45 E
Scilly Iſles, Lights	Europe	Engliſh Chan.	49 56 0 N	6 46 0 W
Sebaſtian St., Cape	Africa	Madagaſcar	12 30 0 S	46 25 0 E
Sedan	Europe	France	49 42 29 N	4 57 36 E
Seez	Europe	France	48 36 21 N	0 9 49 E
Senegal	Africa	Negroland	15 53 0 N	16 31 30 W
Senlis	Europe	France	49 12 23 N	2 35 0 E
Sens	Europe	France	48 11 56 N	3 16 58 E
Senones	Europe	France	48 23 7 N	6 57 0 E
Shepherd's Iſles	Aſia	Pacific Ocean	16 58 0 S	168 42 0 E
Shirburn Caſtle	Europe	England	51 39 25 N	1 0 0 W
Siam	Aſia	India	14 18 0 N	100 50 0 E
Singham-fu	Aſia	China	34 16 30 N	108 43 45 E
Siſterton	Europe	France	44 11 21 N	5 56 4 E
Smyrna	Aſia	Natolia	38 28 7 N	27 18 45 E
Snæfell, Mount	Europe	Iceland	64 52 20 N	23 54 0 W
Soiſſons	Europe	France	49 22 32 N	3 19 28 E
Sombavera, Iſles	America	Caribean Sea	18 38 0 N	63 37 30 W
Soolo	Aſia	India	5 57 0 N	121 15 30 E
Southern Thule	America	Sandw. Land	59 34 0 S	27 45 0 W
Speaker Bank	Aſia	Indian Ocean	4 45 0 S	72 57 0 E
Stalbridge	Europe	England	50 57 0 N	2 23 30 W
Start Point	Europe	England	50 9 0 N	3 51 15 W
Stockholm	Europe	Sweden	59 20 31 N	18 3 55 E
Straumneſs	Europe	Iceland	65 39 40 N	24 29 15 W
Straſbourg	Europe	France	48 34 36 N	7 46 18 E
Succeſs Bay	America	Ter. del Fuego	54 49 45 S	65 25 0 W
Succeſs, Cape	America	Ter. del Fuego	55 1 0 S	65 27 0 W
Sultz	Europe	France	47 53 10 N	7 14 32 W
Surat	Aſia	India	21 10 0 N	72 22 30 E
T.				
Table Iſland	Aſia	N. Hebrides	15 38 0 S	167 7 0 E
Tanna	Aſia	Pacific Ocean	19 32 25 S	169 41 5 E
Taoukaa, Iſle	Aſia	Pacific Ocean	14 30 30 S	145 9 30 W
Taraſcon	Europe	France	43 48 20 N	4 39 36 E

Names of Places.	Cont.	Sea or Country.	Latitude.	Longitude.
			° ' "	° ' "
Tarbes	Europe	France	43 14 2 N	0 3 33 E
Taſſacorta	Africa	Iſle Palma	28 38 0 N	17 58 0 W
Temontengis	Aſia	Soloo	5 57 0 N	120 53 30 E
Teneriffe, Peak	Africa	Canaries	28 12 54 N	16 29 24 W
Tercera	Europe	Azores	38 45 0 N	27 6 0 W
Thionville	Europe	France	49 21 30 N	6 10 30 E
Thomas St., Iſle	America	Virgin Iſles	18 21 55 N	64 51 30 W
Thule, Southern	America	Sandw. Land	59 34 0 S	27 45 0 W
Thury	Europe	France	49 21 28 N	2 18 30 E
Timor, S. W. Point	Aſia	India	10 23 0 S	123 59 0 E
Timor Land, S. Point	Aſia	India	8 15 0 S	131 54 0 E
Tobolſki	Aſia	Siberia	58 12 18 N	68 12 45 E
Tolaga Bay	Aſia	N. Zealand	38 21 30 S	178 33 45 E
Toledo	Europe	Spain	39 50 0 N	3 20 0 W
Tomſk	Aſia	Siberia	56 29 58 N	84 59 30 E
Tonga Tuba, Iſle	Aſia	Pacific Ocean	21 9 0 S	174 46 0 W
Tonnerre	Europe	France	47 51 8 N	3 58 44 E
Tornea	Europe	Sweden	65 50 50 N	24 12 0 E
Toulon	Europe	France	43 7 24 N	5 56 35 E
Toulouſe	Europe	France	43 35 54 N	1 21 3 E
Tournan	Europe	France	48 43 57 N	2 45 15 E
Tours	Europe	France	47 23 44 N	0 41 11 E
Traitor's Head	Aſia	Erramanga	18 43 30 S	169 20 30 E
Tripoli	Africa	Barbary	32 53 40 N	13 5 15 E
Troyes	Europe	France	48 18 2 N	4 4 55 E
Turin	Europe	Italy	45 5 20 N	7 40 0 E
Turnagain, Cape	Aſia	N. Zealand	40 28 0 S	176 56 0 E
Turtle Iſland	Aſia	Pacific Ocean	19 48 45 S	177 57 0 W
Tyrnaw	Europe	Hungary	48 23 30 N	17 33 45 E
U.				
Uliateah	Aſia	Pacific Ocean	16 45 0 S	151 31 0 W
Upſal	Europe	Sweden	59 51 50 N	17 42 15 E
Uraniberg	Europe	Denmark	55 54 15 N	12 52 30 E
Uſhant	Europe	France	48 28 30 N	5 4 33 W
V.				
Valenciennes	Europe	France	50 21 27 N	3 31 40 E
Valery, St.	Europe	France	50 11 13 N	1 37 6 E
Vallery, St.	Europe	France	49 52 12 N	0 41 10 E
Valparaiſo	America	Chili	33 2 36 S	72 19 15 W
Van Dieman's Road	Aſia	Tonga Tuba	21 4 15 S	174 56 24 W
Vannes	Europe	France	47 39 14 N	2 46 26 W
Vence	Europe	France	43 43 16 N	7 7 28 E
Venice	Europe	Italy	45 26 0 N	12 4 30 E
Venus, Point	Aſia	Otaheite	17 29 17 S	149 35 45 W

Names of Places.	Cont.	Sea or Country	Latitude.	Longitude.
			° ’ ’	° ’ ”
Vera Cruz	America	Mexico	19 12 0 N	97 30 0 W
Verd, Cape	Africa	Negroland	14 45 0 N	17 33 0 W
Verdun	Europe	France	49 9 25 N	5 22 50 E
Verona	Europe	Italy	45 26 26 N	11 18 30 E
Verſailles	Europe	France	48 48 18 N	2 7 10 E
Vienna, Obſervatory	Europe	Hungary	48 12 40 N	16 22 30 E
Vigo	Europe	Spain	42 14 24 N	8 28 0 W
Vincent St., Cape	Europe	Spain	37 2 0 N	9 2 0 W
Vintimiglia	Europe	Italy	43 53 20 N	7 37 30 E
Virgin Gorda Fort	America	W. Indies	18 18 0 N	64 0 0 W
Virgin, Cape	America	Patagonia	52 23 0 S	67 54 0 W
Viviers	Europe	France	44 28 54 N	4 41 22 E
Vurtzburg	Europe	Franconiá	49 46 6 N	10 13 45 E
W.				
Wakefield	Europe	England	53 41 0 N	1 33 30 W
Wanſtead	Europe	England	51 34 10 N	0 2 30 E
Wardhus	Europe	Lapland	70 22 36 N	31 6 45 E
Warſaw	Europe	Poland	52 14 0 N	21 0 30 E
Weſtman, Iſles	Europe	N. Ocean	63 20 30 N	20 27 45 W
Whitſuntide, Iſles	Aſia	Pacific Ocean	15 44 20 S	168 20 15 E
William, Fort	Aſia	Bengal	22 34 45 N	88 29 30 E
Willis, Iſles	America	S. Georgia	54 0 0 S	38 29 40 W
Wilna	Europe	Poland	54 41 0 N	25 27 30 E
Wittenburgh	Europe	Germany	51 49 0 N	12 41 30 E
Wologda	Europe	Ruſſia	59 19 0 N	
Worceſter	Europe	England	52 9 30 N	2 0 15 W
Woſlak	Europe	Ruſſia	61 15 0 N	
Y.				
Ylo	America	Peru	17 36 15 S	71 13 0 W
York	Europe	England	53 59 0 N	1 6 40 W
York, New	America	New York	40 43 0 N	74 9 45 W
Yorkminſter	America	Ter. del Fuego	55 26 20 S	70 8 0 W

ERRATA.

Page 25 Line 6, for 1°. 10°. read 1°. 10′.

—— 26 Line 11, for °. read ′.

—— 27 Line 3, for 90′. read 90°.

—— 72 Dele "*and Sea*;" and for *commence*, read *commences*.

—— 75 Line 13, read *paſſes the Meridian*.

—— 82 Line 7, for 113, read 145.

—— 94 Line 9, for °. read ′.

—— 95 Line 4, for 90 read 98.

—— 122 Line 8, for *or*, read *and*.

—— 128 for SSE. read SE.

—— 129 in the Column of Winds for *E.* read *W.*

—— 133 in the Column H. put 11. dele — — — after it.

—— 137 at 4, A. M. for 6 *Fathoms*, read 4 *K.* 6 *F.*—At 6, for 4 5, read 5 5; and at 7, for 5 3, read 4 3.

☞ The Reader is deſired to correct the abvoe Preſs Errors, before he proceeds to the reading of the Book.